

PRIVATE CLOUD: HOW TO CREATE YOUR OWN DIRT-CHEAP
ONLINE STORAGE WITH A RASPBERRY PI

2014

Sept 2014
Issue 406

YOUR EXPERT

GUIDE TO TODAY'S TECH

+

**FREE
SOFTWARE**

Optimise and edit
your digital photos,
search the web in
privacy, customise
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+ more!

BUILDING A STRONGER
TOMORROW

DIVE IN!

Want to help build future
tech yourself? We reveal
what to study and the
key online resources for
hobbyists and
enthusiasts!

FORGING FUTURE TECH

UNCOVERED: THE APPROACHING REVOLUTIONS SET TO ROCK GAMES,
MOVIES, ROBOTICS & AI, AUTOMOTIVE, WEARABLE AND 3D-PRINTING
TECH IN AUSTRALIA – AND HOW YOU CAN GET INVOLVED!

SURFACE PRO 3 TESTED

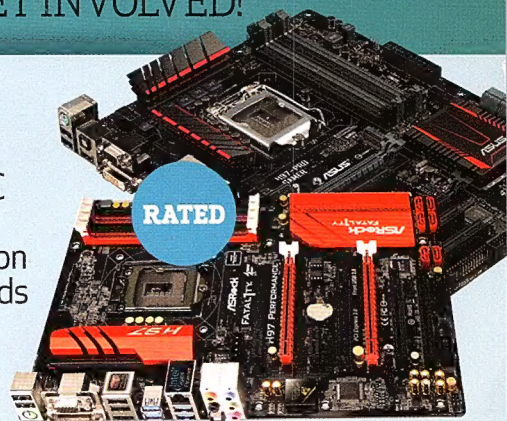
Has Microsoft
finally nailed the
tablet/laptop
hybrid?

PRACTICAL HOW-TOs

- Get better Windows
file management
- Run Android KitKat
on your PC
- Windows apps on Linux
- Get the upcoming
OS X now

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using Intel's latest
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parts — eight boards
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Future



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09



Can a move spark a **transformation?** See it happen with System x.

You've probably heard that IBM® and Lenovo have entered into a definitive agreement where Lenovo plans to acquire the IBM System x server business. This is big news, and it is natural for clients to have a few concerns. This letter from all of us on the System x team is to assure you, our clients, that this strategic collaboration is a benefit for the industry and especially for you.

Perfect Collaboration

Both IBM and Lenovo are dedicated to a larger vision for x86 systems. IBM has long been a leader in client focused innovation of System x servers and solutions, featuring Intel® Xeon® processors. Lenovo is committed to x86 computing and has a proven record of success, as evidenced by their #1 share position in PCs. By leveraging their strengths in scalability, operational efficiency and a broad channel presence, Lenovo will be able to ensure uninterrupted delivery of the innovative System x servers and solutions that IBM offers today. This will create the winning combination to make System x a leader in the x86 segment.

Working for you. Always.

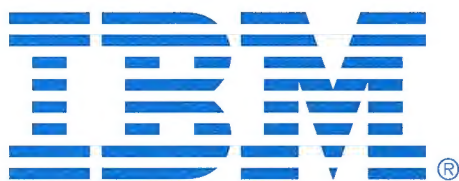
Our respective commitments mean you can continue to rely on getting the performance, reliability, and return on investment you expect for your IT infrastructure. Our team has always been dedicated to delivering exemplary levels of service. We are happy to inform you that IBM will continue to service the System x installed base for an extended period after the transaction closes, so you experience the same quality and accountability that you have come to trust over the years. What's more, we – the 7500 members of the IBM team that delivers System x servers – will continue to do the same, as we will also move to Lenovo.

At IBM, we have always been proud of our ability and commitment to meet the needs of our clients. This announcement opens new avenues for us to expand and improve on this tradition.

Please do visit ibm.com/futureofx/au to learn more about this development.

Sincerely,

The entire System x Team



Future Publishing Australia,
PO Box 1077, Mount Street, North Sydney, NSW 2059
Tel: 02 9955 2677 Fax: 02 9955 2688
SUBSCRIPTION ENQUIRIES: Please call Magshop 13 61 16
Email: apcmag@futurenet.com
Web: www.apcmag.com

EDITORIAL

Editor Dan Gardiner
Managing Editor Melanie Pike
Features/Disc Editor Peter Dockrill

ART/PRODUCTION

Art Director Troy Coleman
Senior Designer Sally Ryan

CONTRIBUTORS

Jonni Bidwell, Matt Bolton, JR Bookwalter, Helen Bradley,
Richard Dyce, Craig Grannell, Christian Hall, Tim Hardwick,
Phil Iwaniuk, Dave James, Farha Khan, Tom McNamara,
Richard Moss, Nick Peers, Matthew JC Powell, Bennett Ring,
Craig Simms, Luis Villazon, Philippa Warr, Darren Yates,
Alaina Yee.

SENIOR MANAGEMENT

Chief Operating Officer Neville Daniels

COMMERCIAL

Sales Director Paul Marttila
paul.marttila@futurenet.com

Sales Director Chris Espey
chris.espey@futurenet.com

ABOUT THE MAGAZINE

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Tomorrow's real tech

APC's editor puts in his
two cents on the tech hype
cycle and what tomorrow
will really bring...

One of the great things
about computing – and
technology in general – is
that there always seems to
be something bigger and better
just around the corner. (Well,
perhaps that should be smaller
and better...) We are passionate
lovers of tech here in Australia as
well as consummate early
adopters, outdoing our northern-
hemisphere neighbours in the UK
and US when it comes to things
like the uptake of smartphones
and wearables. (Back in
September last year, a study by
research firm Pureprofile showed
some 35% of Australians had
already used some form of the
latter, compared to just 18% in the
US and UK, which backs up
previous findings about our
proclivity for new technology.)

The tech hype cycle doesn't
always live up to its promises,
however, so (sexy cover art aside)
with this month's cover story we've
taken a slightly more grounded
approach to what's coming our way
and at the same time – we hope –
peeled back at least a little of the
mystery surrounding some of the
biggest trends in today's tech.
(Mystery is, of course, a big part of
generating hype, so you'll have to
excuse us if you're not so easily
swayed by the latter after reading
this month's stories.)

Of course, there's really nothing
like rolling up your sleeves and
getting involved yourself –

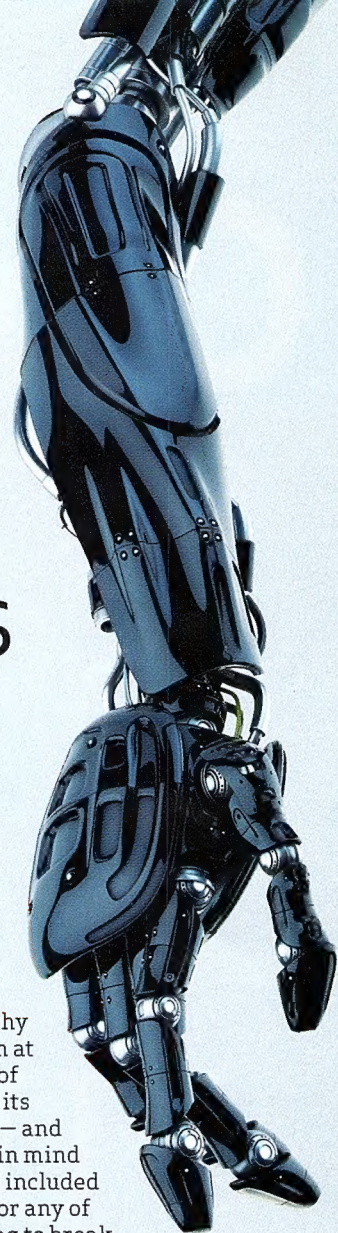
a philosophy
that's been at
the heart of
APC since its
inception – and
with that in mind
we've also included
pointers for any of
you looking to break
into these industries,
or even those who'd just like to look
into some of them as a hobby.
Whether you want to build robots,
create games, or make your own
movies, the tools to do so are more
readily-available now than ever
before, amply proving that there
has, perhaps, never been a better
time to be a tech tinkerer.

With the tech scene constantly
changing, I'd also like to point out
briefly that the list of topics we've
covered in this issue is hardly
exhaustive and, as such, I'd like to
invite you to let us know if there
are any other areas of tech that
you'd like to see given a similar
treatment. As always, shoot us any
feedback or ideas you have to
apcmag@futurenet.com – and
enjoy the issue!



DAN GARDINER

EDITOR
dan.gardiner@futurenet.com



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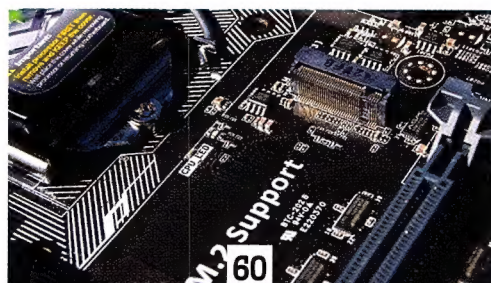
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FORGING FUTURE TECH

UNCOVERED: THE APPROACHING REVOLUTIONS SET TO ROCK GAMES, MOVIES, ROBOTICS & AI, AUTOMOTIVE, WEARABLE AND 3D-PRINTING TECH IN AUSTRALIA – AND HOW YOU CAN GET INVOLVED!



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CROSSING THE DEVIL'S CANYON

WITH A MODEST BUDGET OF \$200, CRAIG SIMMS GRABS AN INTEL H97 AND Z97 MOTHERBOARD FROM EACH VENDOR AND PUTS THEM THROUGH THEIR PACES, AND RECOMMENDS THE BEST NEW INTEL CPUS TO GO WITH 'EM.

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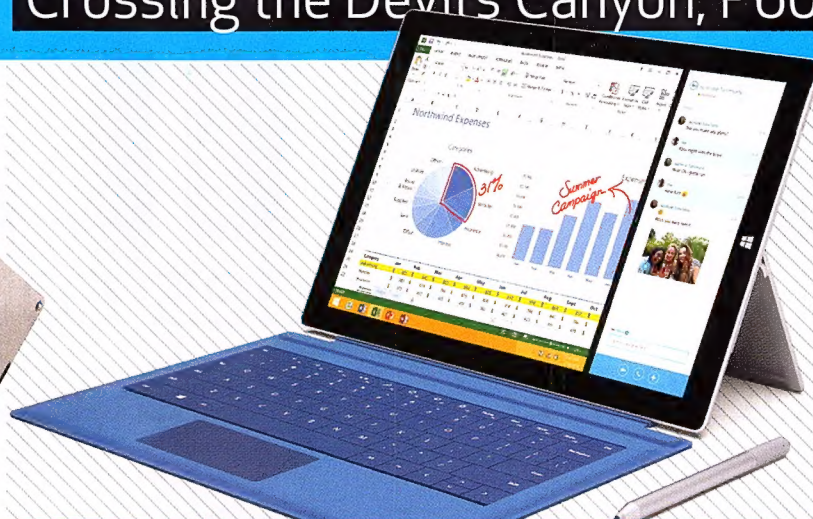
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Not everything is plain sailing in the tech world.

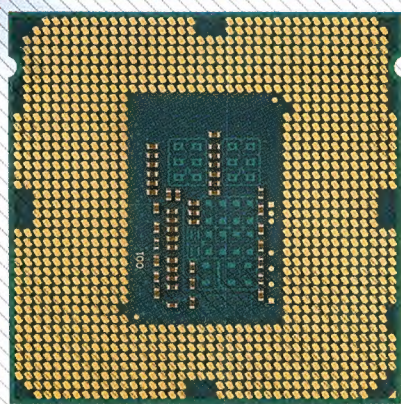
"At this point, ask yourself if you will only ever use one graphics card — if the answer is yes, consider an H97 board over Z97" Crossing the Devil's Canyon, P60



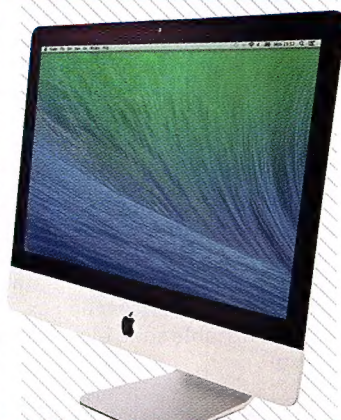
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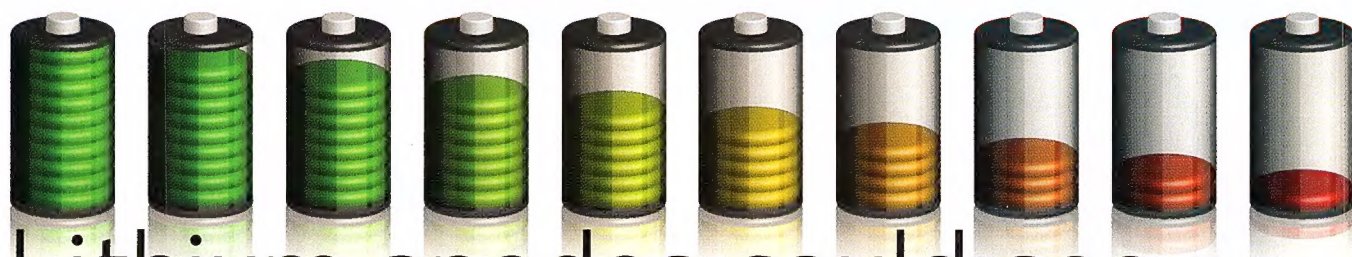
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- » Ashampoo Photo Optimizer 5
- » Abelssoft GoogleClean
- » 1-abc.net Right Click Configurator
- » Pioneer [full game]
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technotes

» NEED TO KNOW



Lithium anodes could see major battery breakthrough

Sick of running out of juice? New Stanford research points to lithium batteries with far greater efficiency.

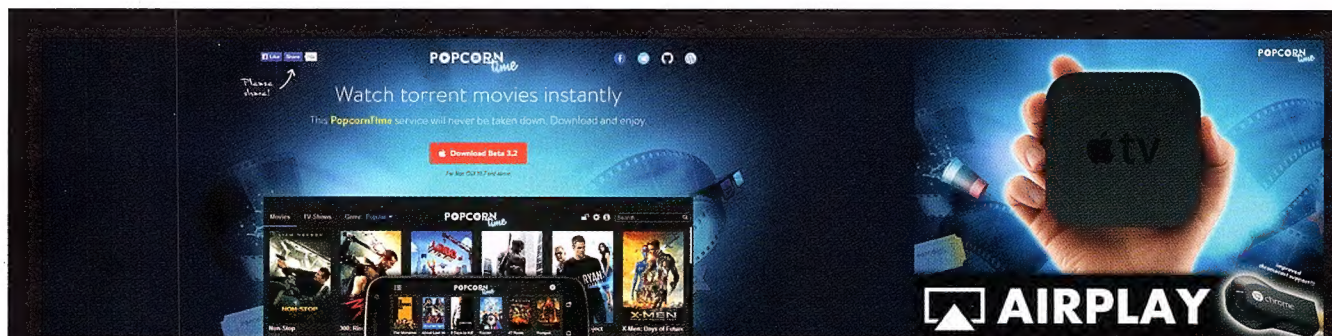
Compared with the rapid innovation we see in components like processors, graphics chips, displays and wireless standards, the relatively standstill nature of battery technology ensures it's frequently pegged as the bottleneck in our mobile and portable devices, but new research from Stanford University could see us reap the benefits of significantly more efficient lithium-based batteries.

While conventional lithium-ion

batteries usually incorporate anodes composed from graphite or silicon, the researchers, Guangyuan Zheng and Steven Chu, have discovered a process whereby lithium itself can be used safely and consistently as the anode — resulting in far greater battery efficiency — by coating the anode with a “monolayer of interconnected amorphous hollow carbon nanospheres [that] helps isolate the lithium metal depositions and facilitates the formation of a stable solid electrolyte interphase.”

What does this mean for you? It's estimated the technique, if it proves workable in industry, could provide lithium anode batteries with three or four times the capacity of today's lithium-ion components, and the advancements won't only impact mobile tech.

As Chu told **Phys.org**, the discoveries could theoretically lead to development in electric transport too: “You might be able to have an electric car with a range of 300 miles that cost only \$25,000 — competitive with an internal combustion engine getting 40 mpg.”



Popcorn pirates embrace Apple (it's not mutual)

Popcorn Time, the controversial BitTorrent program that enables easy, instantaneous streaming of downloaded movies and TV shows — earning it the nickname, “Netflix for pirates” — appears to be going from strength to strength. Despite ongoing shutdown efforts by the MPAA (Motion Picture Association of America) and a somewhat tortured development thus far — which saw the original project shuttered by its founders almost directly after launch, before the code was picked up and forked by other developers — Popcorn Time is now available on a multitude of platforms, including Windows, Mac, Linux, Android and Chromecast, and it's soon to start showing in an even more surprising place: iOS.

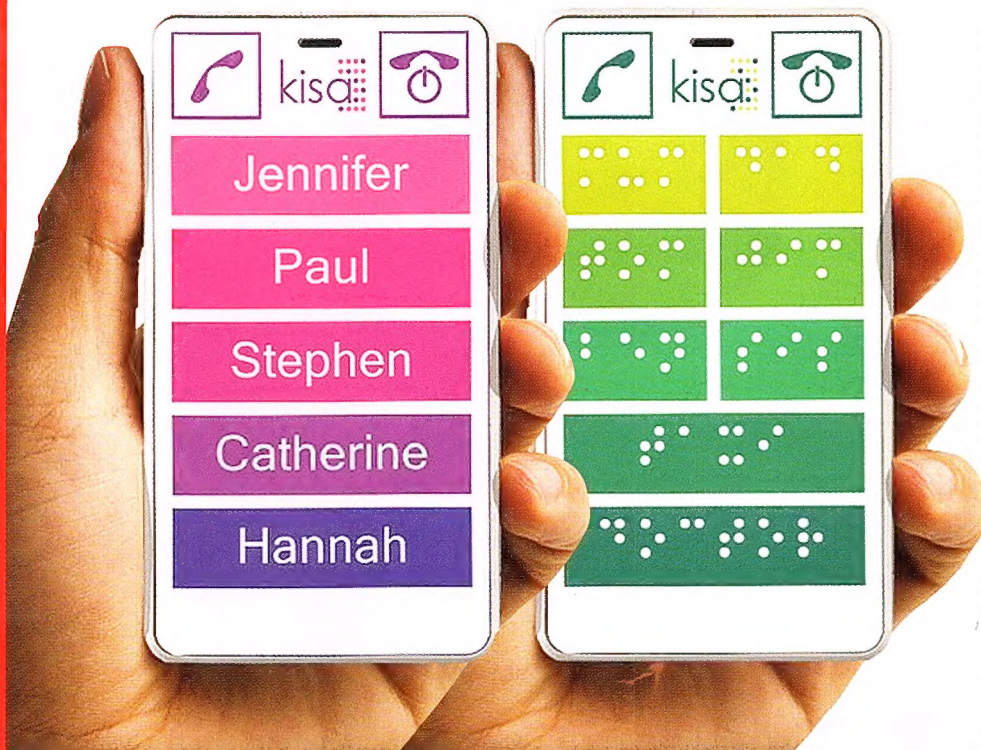
Popcorn Time's developers are rolling out AirPlay support to the desktop apps, meaning users will soon be able to stream directly to the Apple TV and other AirPlay receivers, and a native iOS app is also on the way — just don't expect to see the Popcorn Time app show up on Apple's App Store (it'll be a strict jailbroken-devices-only affair). As one of Popcorn Time's developers told TorrentFreak, “Our ultimate goal is to bring Popcorn Time to every platform, operating system and device that can play videos, so AirPlay is one particle of a huge revolution we're making to the torrents and movies world online. This is only the beginning... You know us, we have many more surprises coming your way.”

Tor received \$1.8 million from the US government

The Tor Project which allows users to browse the internet anonymously, by bouncing connections through encrypted "relays", is reporting that it received over US\$1.8 million from the US federal government last year. Interestingly, though Tor is becoming more popular for use by organisations and nations looking to evade surveillance by the "West", US government funding for the Tor project in 2013 doubled since 2012. While the bulk of this funding comes from non-profit organisations SRI International (an R&D centre that aims to bridge the gap between abstract research and industry) and Internews Network (which funds programmes supporting democracy and human rights), the total also includes funding from the US Department of Defense (\$100,325) and the US State Department (\$256,900). Ironically, the news comes after it was revealed by *The Guardian* that the US government agency NSA had reportedly been trying to attack and bring down Tor, or at least de-anonymise the users.

China's search giant Baidu working on driverless cars

Like Google, China's most popular search engine Baidu is also working on an automated vehicle. Unlike Google, however, Baidu wants its drivers to have the option to maintain control of the car. "We don't call this a driverless car. I think a car should be helping people, not replacing people, so we call this a highly autonomous car," said Kai Yu, the deputy director of Baidu's Institute of Deep Learning. Baidu's cars will have a steering wheel, accelerator and brake pedal, rather than the sensors and software used by Google. Yu says that Baidu's car is essentially like riding on a horse. "I think in the future, a car should not totally replace the driver but should really give the driver freedom. Freedom means the car is intelligent enough to operate by itself, like a horse, and make decisions under different road situations. Whenever the driver wants to resume control, you can do that." Baidu's prototype self-driving car will make its first appearance in 2015.



Aussie start-up Kisa brings simplicity to mobile phones

A mobile that's just a phone.

Australian start-up Kisa has designed a mobile phone alternative for parents with very young children, the visually impaired, and those living with reduced physical abilities. Only available in Australia so far, Kisa also developed three simple mobile plans for call making using the Vodafone network.

The company consulted with Vision Australia and Guide Dogs Victoria to create the easy to use phone and while

it looks a bit like a toy, the \$84 simple, yet accessible handset features no screen and only one button for call making. The Kisa doesn't have a camera, the ability to go online or even send SMS messages. The phone does however include a large SOS button and can store a customers' critical medical information. Up to 10 contacts can be customised and identified by a photo, name, high contrast colour combination and Braille, and be stored in any language.





US\$1m

Crowd-funded 'robot for the home' project eclipses its funding goal ten-fold (in less than a week).

If science-fiction movies have taught us anything, it's that we'll be surrounded by all manner of utilitarian domestic robots in the future — and if they're half as friendly-looking as 'JIBO', we wouldn't mind a bit. "The world's first family robot" is a pint-sized personal assistant who interacts with you from the desk or floor, taking photos, conversing, sending messages and ordering take-away food (if the slick pitch video is to be believed, tinyurl.com/lpkxbk9). Yours from US\$499 for the Home Edition, get in quick.

34%

Google's WebP image format offers file sizes up to a third smaller than JPEG.

Ordinary people don't spend too much time thinking about image files — strange, we know! — and probably couldn't explain even the obvious differences between a JPEG and a PNG. They like GIFs though (especially if they're funny or sexy) and almost none of them have heard of WebP. Google's fighting an uphill battle trying to get browsers to support its data-efficient image format — which is leaner and more flexible than current standards — and Mozilla's newly announced improved JPEG encoder, 'mozjpeg 2.0', suggests unification around any new image file standard won't be happening any time soon. Which unfortunately means a slower, heavier and more expensive web for everybody...

2:1

Ebooks without DRM sell twice as many copies as ebooks with DRM.

Everybody hates DRM. All it's supposed to do is make stuff harder to steal — which, in theory, is commendable — but it invariably gets in the way, making it harder to enjoy your paid-for content in the ways you want. And that's not the only negative, either: according to AuthorEarnings' July report, ebooks without DRM by independent publishers on Amazon sell on average twice as many copies as titles carrying the restrictions (and at every pricepoint), with the theory being that honest, savvy consumers are electing to steer clear of hobbled, locked-down content when they have the choice. Authors, publishers and content creators everywhere, take note.

8.5%

One prolific Wikipedia author is responsible for a rather large chunk of the online encyclopaedia.

Yes, you read that right. 53-year-old Swede Sverker Johansson has been busy, and with a little help from his friends (meaning the web-scraping bots he has programmed to fill out Wikipedia entries on his behalf) has created some 2.7 million articles for the world's fifth-most popular web site. According to *The Wall Street Journal*, which recently published a feature on Johansson, a "vocal minority" of Wikipedia purists don't approve of his robotically assisted methods.



2x

Prohibition seems to suit the traffic-doubling Pirate Bay.

The Pirate Bay might be continually hounded from one country to another — and is neverendingly being blocked, censored or filtered by search engines or ISPs around the world — but do you think the infamous piracy outfit is concerned one iota? Nope! The controversial web site recently disclosed that its web traffic has actually doubled since 2011, with the majority of its audience hailing from the US.

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technotes

» GEAR WE WANT



NVIDIA SHIELD TABLET

FROM US\$299 | WWW.NVIDIA.COM

The graphics guru is expanding its handheld Shield line with an 8-inch Full HD tablet powered by the quad-core 2.2GHz Nvidia Tegra K1 processor, compatible with its own wireless controller for full console-style play (on a pretty small screen). As a platform, Shield's advantage is it can already play hundreds of Android games (including exclusives like *Portal* and *Half-Life 2*) and stream PC games to boot, so the only real question is: do a tablet and a wireless controller really belong together? Hmm.

NETGEAR NIGHTHAWK X6

\$400 | WWW.NETGEAR.COM.AU

The follow up to last year's frankly excellent Nighthawk R7000. Now, that unit wasn't exactly a small model, but the X6 outdoes it with an even bigger footprint and a dedicated laptop-style power brick to run the thing. This is clearly not a router for users who just want something to meekly and discretely sit in the corner. Its main advantage over its predecessor is an additional 5GHz 802.11ac radio. While this doesn't increase the speed limit (still at a theoretical 1.3Gbps) it should allow for faster speeds on networks with lots of connected devices. Oh, and it doubles the antenna count from three to six. We got our hands on one of these just as we were going to print, so look out for a review next month.



ONEPLUS ONE

FROM US\$299 | ONEPLUS.NET

Want a big and ballsy flagship smartphone for about half the usual \$800 price tag? That's the promise of Chinese smartphone maker OnePlus, with its premier device called the One (not to be confused with HTC's similarly-named handset). Priced at US\$349 for the bigger 64GB version, it packs a 5.5-inch 1080p LCD display, 2.5GHz Snapdragon 801 processor (aka what's inside the Galaxy S5), 3GB of RAM, large 3,100mAh battery and 4G support. The One's a bit of an oddball though, in that it's been available for a couple of months, but is still hard to actually get your hands on. That's thanks to a bizarre sales strategy by OnePlus: you've got to be invited to buy one, which means knowing someone with one, or being willing to participate in contests on OnePlus's site and forums. If you get hold of one, feel free to shoot us an invite...



NOKIA X2

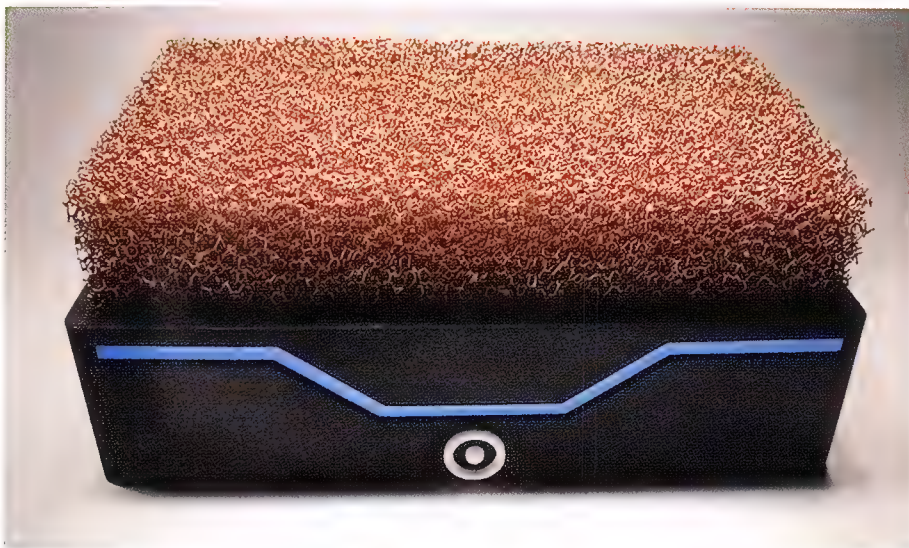
€99 | WWW.NOKIA.COM

If it were a little less mass-produced, Nokia's X series might just go down in tech history as one of those prized collector items capable of fetching outrageous sums at auction – the kind of unlikely gadget which attracts curiosity due to its sheer oddness and implausibility. What makes the Nokia X so unusual? It's a smartphone made by Microsoft (which owns Nokia) that happens to run on Android: yep, the OS made by staunch Microsoft rival Google, which competes with – and almost invariably trounces – Microsoft's own struggling smartphone platform, Windows Phone. This second iteration of the budget-range X, not officially announced for Australia, sports a 1.2GHz Snapdragon processor, a 4.3-inch display and dual sim slots. The X2 was only made public in June, but less than a month later Microsoft effectively announced the Android experiment was over, with the company saying future X models would transition to the stock Windows Phone Lumia line. Going, going... gone.

SILENT POWER PC

FROM €699 | WWW.SILENTPOWERPC.DE

This German-built, brick-sized desktop PC is currently seeking crowd funding and it's main pitch – as the name suggests – is that it makes no noise whatsoever in operation. The claim is that it can accomplish this by using copper foam to passively cool the internal hardware – which is a fairly impressive 2.2GHz quad-core Intel Core i7-4785T CPU, 8GB of RAM, Nvidia GeForce GTX 760 and a 500GB SSD for the basic model. The final version isn't expected to ship until sometime in 2015 and getting on board now will set you back between €699 to €1,159 (around AU\$1,000 to AU\$1,665), depending on specs.



PICK ANY COLOR

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SCRIBBLE PEN AND STYLUS

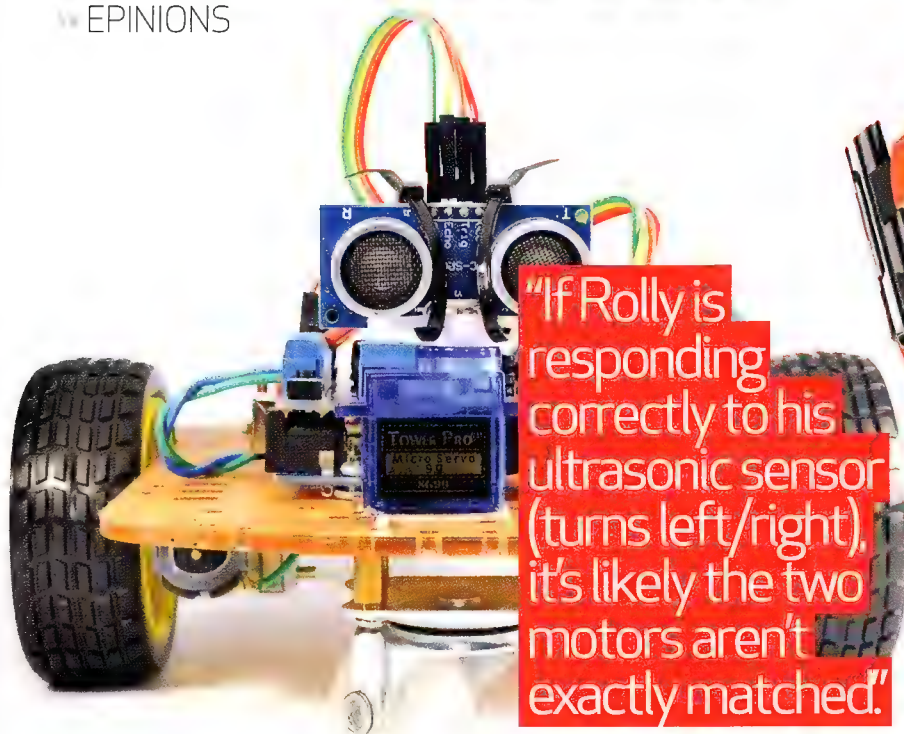
PEN, US\$150; STYLUS, US\$80 |

GETSCRIBBLEPEN.COM

Imagine a pen that could write in any colour. Scribble Pen can do just that, and Scribble Stylus brings the same functionality to your mobile devices. An advanced colour sensor in the top of the pen or stylus captures colour from any object. The pen then mixes this colour using its multi-coloured ink cartridge, while the stylus pairs with a mobile app to transfer this exact shade to your iOS, Android or Windows Mobile device. PC and Mac software is also planned. No word yet on actual availability. ■

technotes

OPINIONS



"If Rolly is responding correctly to his ultrasonic sensor (turns left/right), it's likely the two motors aren't exactly matched."

DIZZY ROBOTS

I have just finished the Rolly Robot Mk. II, and because of your very good instructions I got it to work! It doesn't go in a straight line, but it does go around in very large circles, it's no big problem but I'm working on it. When you publish a brilliant article in APC so simple even I can get it going, it makes me glad I subscribe to your magazine!

Max Tewes

Darren Yates replies: Great to hear, Max! If Rolly is responding correctly to his ultrasonic sensor (turns left/right), it's likely the two motors aren't exactly matched, so adjust the MAX SPEED OFFSET line at the top of the sketch (source code) and make it either a larger negative or positive number (no more than 40) until you get a straight line. This number is a differential to vary the speed of the motors. Best of luck!

XBMC PI PROBLEMS

In the last issue, you had an extended article about XBMC. While the article was great, I would like to add a couple of things. I tried XBMC as software installed into Windows, it was great, so I thought I would get myself a Raspberry Pi and use it as a home media centre using OpenELEC. What a waste of money – XBMC is free, but Raspberry Pi is not. In your article, one sentence that struck me was "...will play anything you through at it...". My XBMC on Raspberry Pi plays most video files as audio only, and fails to install most add-ons (on an 8GB card). I Googled it, there's not one single answer to the question. So while XBMC is good software, it still lags behind as a stand alone media centre. Can you guys shed more light on it as a media centre on Raspberry Pi? Maybe I missed something.

Mohammad Hajarat

Ed replies: We're currently looking at putting together a detailed how-to guide on running OpenELEC on the Pi, so stay tuned Mohammad!



Win
an Astro A40 Pro-Gaming headset!

Thanks to Bluemouth Interactive (www.bluemouth.com), this month APC readers have the chance to win an Astro A40 Pro-Gaming headset including a bonus MixAmp Pro, worth a total of \$329.

The A40s are a great-sounding set of cans and a previous winner of APC's Editor's Choice award and with the MixAmp Pro includes perks such as a quick-disconnect cabling system, media controller cable, removable mic system and customisable speaker tags.

To enter the competition, head to tinyurl.com/apc406comp and tell us why you deserve a new gaming headset.

Entries close September 17th. For full competition terms and conditions see the competition web site.

APCMAG@FUTURENET.COM

Come on, have your say!

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Pest removal

The dangers of online accommodation services are laid bare when the tenant from hell moves in — but won't move out.

For every wondrous new capability that technology affords us, it seems there's inevitably an accompanying necessary evil to take into account: an unforeseen risk, flaw or side effect that takes some of the glitz off our shiny new toy. Case in point: Airbnb. This hugely successful web service has revolutionised the accommodation landscape in recent years, making it easy for tourists and travellers to discover lodgings online across 190 countries around the world, providing a much-needed web nexus between people looking for a place to stay and property owners (or sub-letting tenants) who have some spare space on their hands.

The only catch is, you never really know beforehand who you're dealing with. With eBay, for example, a dodgy seller or buyer is limited to a one-time bad retail experience; with Airbnb, on the other hand, a negative episode can be an altogether more scary, intractable prospect, as you're potentially inviting the tenant from hell into your home (or bunking with a landlord from the same place).

At least, that's what one US landlord found when she rented her holiday



Start Your Adventure

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home to a tenant through the site. Cory Tschogl, 39, unwittingly opened up her home to a vexatious squatter, who complained about the tap water, guzzled four times as much electricity as normal tenants, didn't pay his bill, left emails and phone calls unanswered and then finally refused to move out at the end of his stay. When Tschogl threatened to turn off the electricity, finally the tenant from hell — who was now shielded by Californian renter protection laws — offered a vindictive response:

"I have consulted my attorney. As I said multiple times already, I am LEGALLY occupying the domicile. My nature of work from home is dependent on having electricity, and my income while working averages \$1,000-\$7,000 per day, involving over 2,000

as well as medical bills for my brother's hospital visit after he got sick here drinking unfiltered tap water (Ulcer). Not only what you do is illegal, it is also extremely discriminatory in nature and had caused me and my brother a lot of stress and suffering..."

Luckily, once Tschogl's plight became publicised on social media, Airbnb belatedly came to her aid with financial compensation and legal assistance, but it just goes to show the intrinsic risks of renting your home out via a relatively unvetted and anonymous digital service — and in any case, the legal eviction process, now that Tschogl's tenant is in residence, is expected to take months before coming to a resolution. Do you have any Airbnb horror stories you'd care to share?

Email us at apcmag@futurenet.com.

ENDUSER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

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	0 50 100 150 200 250
3DMARK ICE STORM	OVERALL SCORE
MICROSOFT SURFACE PRO 3	38,612
MICROSOFT SURFACE PRO	37,762
	0 10,000 20,000 30,000 40,000 50,000
3DMARK CLOUD GATE	OVERALL SCORE
MICROSOFT SURFACE PRO 3	4,487
MICROSOFT SURFACE PRO	3,405
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TABLET

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Microsoft Surface Pro 3

A hybrid we'd take everywhere.

When the original Surface Pro launched, no one quite knew how to classify the hybrid. Was it a tablet that was trying to be a laptop? A laptop trying to be a tablet?

Well, we're going to say the Surface Pro line is neither; it doesn't need to be — the Surface Pro 3, it combines the best of both worlds.

At just 800g (1.1kg with the optional Type Cover attached) and 9.2mm thick, it's one of the lightest and slimmest x86 ultraportables yet. When thrown into a backpack or shoulder bag, the Surface Pro 3's barely noticeable. And given its generous size — the SP3 has a 12.1-inch, 2,160 x 1,440 IPS screen — it's a bit of a marvel that its internals include a Core i5-4300U CPU, 8GB of DDR3 RAM, and a 256GB mSATA SSD. And unlike its first-generation predecessor, the Surface Pro 3 runs cool and, for the most part, very quiet. Even when the fan is under load, it's still more of a hum than a turbo-engine.

Of course, there are trade-offs for cramming so much in, with the additional requirement of being cool and quiet. While it performed slightly better than the original Surface Pro, during intensive loads we saw a decrease in performance. We suspect this is due to the system favouring thermals over performance. Don't expect to play triple-A titles on the SP3 — or even farm league games; we barely cracked 16fps in *Batman: Arkham Origins*. It did run the Little League-level *Super Meat Boy* at 50 fps and *Limbo* at 29.4 fps, so there is some fun. Heavily threaded loads also are best left to a beefier systems, as our ProShow 5 benchmark (limited to four threads) took almost an hour to complete.

But as a hybrid, the Surface Pro 3's hard to beat. With its multi-point kickstand, you can adapt it to a wide variety of scenarios — particularly when combined with the updated Type Cover, which sports a magnetic strip that clings to

the bottom edge to provide additional stability. We liked being able to do actual work — between its ample screen and 3:2 aspect ratio, doing daily tasks like writing articles, crunching numbers, and creating presentations on the go are actually comfortable — while also jumping to more tablet-like functions like watching Netflix, trawling through YouTube for cat videos, and reading magazines through Zinio. Taking notes by hand via OneNote on the touchscreen is as good as in previous models, though sadly, nothing will ever counteract our chicken scrawl. And its battery life is pretty good, lasting 242 minutes in our rundown test.

Our real quibble with this machine has not to do with its hybrid status, but with its accessories. Though the Type Cover's trackpad is vastly improved over the SP2's version, it can be a bit hypersensitive. It's also surprising that the Type Cover is still so expensive. We're also not huge fans of

the pen loop that holds the stylus, as we're pretty sure we'll lose the instrument due to the loop tearing or losing its adhesive stickiness in about a month.

Still, these are entirely minor complaints, and we're still more than happy to deal with them as part of being able to trade a few devices in our bag for just one. Haters are going to kvetch about how it's not what they'd spend their money on, but if you've been an ultraportable fanatic well before Intel began its Ultrabook push, you'll love just how much hardware is in this svelte form. ■ Alaina Yee

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Thin and light; multi-point kickstand; runs cool and quiet. But, twitchy touchpad on Type Cover.



"What Apple has essentially done is take its existing 21.5-inch mid-range iMac and swap out its decent quad-core CPU/Iris Pro guts for the MacBook Air's."

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Apple 21.5-inch iMac

Is this new cheaper iMac the all-in-one for all? Not yet...

Apple hardware isn't cheap. We'll admit this isn't 100% breaking news, but let's put our appraisal of this new iMac in context. Apple doesn't make low-end machines, but when you balance the build quality, reliability and mix of design and specs, they're not insanely overpriced. You may not want the kind of computers that Apple sells, but if you do, their cost is largely on par with competitors. Except this new, low-end iMac, which simply costs too much.

What Apple has essentially done is take its existing 21.5-inch mid-range iMac and swap out its decent quad-core CPU/Iris Pro guts for the MacBook Air's. You end up with a desktop computer running a weedy 1.4GHz Core i5-4260U processor, yet prices start at \$1,349. Worse, its 500GB hard drive is a slow 5,400rpm spinner, meaning that it actually feels slower than a MacBook Air, which

has an SSD to keep it nippy.

The iMac has 8GB of (non-upgradeable) RAM, at least, but that's hardly mind-blowing for the price.

Apple has only skimmed on the core specs of this iMac rather than the other features. The display is a fantastic 1080p IPS panel, offering brilliant colours and few reflections, despite its glass coating.

There's a reasonable range of connections, including two Thunderbolt ports, which offer loads of flexibility, and 802.11ac Wi-Fi. Apple's wireless keyboard is still one of the best out there for typing, too (though its mouse remains quite possibly the single worst for gaming). And though not everyone cares about a desktop being slim, the blade-like iMac is a hell of a sight – stark aluminium and glass, just a few millimetres thick at the edges, and taking up a tiny desktop footprint.

And, unsurprisingly, it runs perfectly well for light use – music, movies, web

browsing and documents. OS X is designed to be smooth and light on low-power machines, and Windows 8.1 is perfectly snappy in Boot Camp too.

But it is a \$1,349 machine, and one that lacks the headroom to go beyond these tasks (try doing photo or movie editing and the lack of speed will be apparent) and zero opportunities for upgrades. It's a similar story with games: 8GB of RAM and an Intel HD 5000 GPU mean that 2D games and low-end 3D stuff generally run fine, but playing anything reasonably intensive at the screen's native 1080p is a tall order (even on Windows, where games perform better than on OS X).

Ultimately, Apple's newest iMac isn't a bad computer, it's just a bad deal. You could buy a MacBook Air (which would actually perform better) and a separate 22-inch IPS screen for less than this iMac – or a Mac mini and a screen. If you want an all-in-one, we'd look

at Dell, Acer or ASUS's offerings, and, more specifically, aim for an SSD boot drive as well. The latter might mean it ultimately costs a bit more, but the rewards in increased usability are worth it.

The iMac has a few extra features going for it, but just not enough to make it any more than a nice PC at the wrong price. ■ Matt Bolton

LABS BENCHMARK RESULTS

DirectX 11 gaming performance

TOMB RAIDER	AVERAGE FPS, HIGHER IS BETTER
IMAC (OSX 10.9)	13
IMAC (WINDOWS 8)	22

CPU rendering performance

CINEBENCH R11.5	INDEX SCORE, HIGHER IS BETTER
IMAC (WINDOWS 8)	2.61

Verdict

Features
Performance
Value



A beautiful screen and sharp design can't hide the fact that this simply costs too much, even for Apple.





The smart choice in SSDs

Samsung's EVO family of solid-state drives offer the most compelling mix of performance, price and capacity on the market.

➔ SSDs have transitioned from niche products made for enthusiasts and professionals to something that every PC should have. As SSDs have aptly proved, traditional platter-based hard drives can be a huge bottleneck when it comes to performance, with today's SSDs offering up to five times the speed when it comes to reading and writing data — and many times that in more seek-intensive tasks, like the random reads and writes that make up most of our day-to-day computing tasks. In short, if you want a computer that not only boots up and loads apps quickly, but is also incredibly responsive, then an SSD upgrade is a must.

So which SSDs are the best-value proposition in today's market? There's a lot of competition from SSD makers (both big and small), but of all those, Samsung's EVO line of drives has the most persuasive range of products. If you need a big SSD, Samsung's EVO range features the largest consumer drives available, with models ranging up to a whopping 1TB.

Feeling the need for speed? The EVOs consistently perform on-par with — and often better than — more-expensive drives from other

SSD manufacturers. And that potent mix of capacity and speed isn't going to cost you an arm and a leg either — the EVOs are some of the best-value SSDs available and they can be scooped up for less than \$1 a gig.

EVO drives also include exclusive technologies, such as Samsung's Magician software, which can make it easy to transition your PC or laptop from your old drive to your new EVO SSD. Magician also includes the innovative RAPID Mode, which detects frequently-used data and caches it to DRAM. This not only helps improve performance, but can reduce wear and tear on the SSD itself.

Samsung is an undisputed expert when it comes to flash storage. Its chips don't just end up in its own devices (including its popular Galaxy smartphones), but even in products from its major competitors. It's this level of integration that helps Samsung put together the most compelling SSDs currently available. Whether you're looking for an inexpensive way to upgrade your laptop's hard drive to turn it into a lightning-fast portable PC, or putting together the plans to build your next killer gaming rig, Samsung's EVO line up is the smart choice when it comes to SSDs.



The 840 EVO at a glance

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Up to 1TB (1TB = 1 trillion bytes)

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Interface
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Dimension (WxHxD)
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Weight
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Cache Memory
Samsung 1GB Low Power DDR2 SDRAM

Application
Desktop PC & Laptop PC



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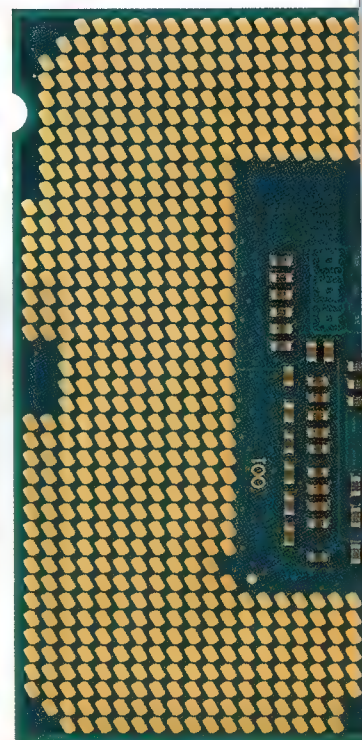
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Intel Pentium Anniversary Edition G3258

Once more, for the old school overclockers...

The Devil's Canyon Core i7 and i5 Haswell updates may not have been the super-exciting enthusiast overclocking processors that we maybe expected and definitely wanted but, as Obi Wan was wont to say, there is another.

Celebrating the 20th anniversary of the Pentium brand, Intel has opened up the dual-core Haswell silicon, finally giving us access to the lower-end CPU's multipliers. Yup, this could be the exciting overclocking processor we've been hankering for.

The G3258 is the CPU name for this Pentium Anniversary Edition chip, and it's a bona fide Haswell processor with a pair of those 22nm 4th Gen cores working away inside of that processor package. Like the K-Series chips alongside it, the G3258 comes with an unlocked multiplier, finally allowing us access to the overclocking goodness that we know resides inside Intel's silicon architecture. We've been praying for Intel to relax its iron grip on the lower end of its processor lineup ever since it decided to lock down the overclocking performance of the cheaper chips, restricting it to higher-end processors with a price premium.

The marketing reasons for Intel cutting out low-end overclocking are

pretty straightforward. As a company, you'd rather people buy your expensive processors than opt for cheaper CPUs and push their performance up themselves, even if the capability is there. So the K-Series was born and that performance was jealously guarded by the Core i5 and Core i7 processors, keeping it away from the lowly dual-core Core i3s.

It's a shame though that this brief turnaround is unlikely to represent a return to the good ol' days of brilliant Intel budget overclockers, and that it's taken the Pentium anniversary to prompt it to remind people what it used to be like.

Because this is what overclocking used to be about. It wasn't really about getting a \$1,000 processor to perform a tiny bit quicker in some synthetic benchmark with a liberal application of liquid nitrogen. It was about taking a CPU you could actually afford and tweaking the BIOS to get extra performance out of it, which would then translate into tangible gains in-game.

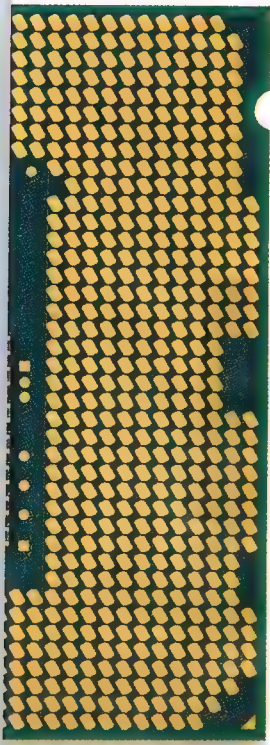
We want to say then the G3258 represents a great return to form for Intel, but because we've known this potential has been hanging around its lower-end processors for years, it's

almost like it's a chip on day-release from marketing prison for a special occasion. For the moment though we can happily forget all the marketing and technology politics because the Pentium anniversary party is in full swing and the G3258 is the guest of honour.

CUT-PRICE CLOCKS

Out of the box, the 3.2GHz clock speed is pretty weak, especially seeing as there's no HyperThreading enabled on this chip or Turbo mode to smooth things out. The single-threaded performance then is understandably poor and, with only a pair of cores to play with, moving on to multi-threaded benchmarks the numbers don't really make for any happier reading. In gaming terms that weak clock speed means in most of our gaming tests the G3258 offers some 15-20% lower average frame rates than the non-K-Series i5 4570, and in the more multi-core optimised *Battlefield 4*, the Pentium Anniversary chip posts frame rates that are over 40% slower.

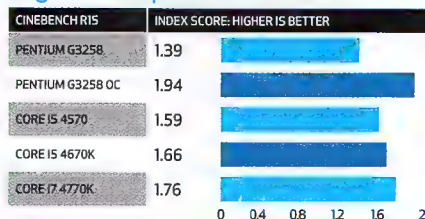
The G3258 is around a third of the price of that quad-core Core i5 though, so you'd expect it to be a good bit weaker in terms of gaming performance. Still, with those numbers



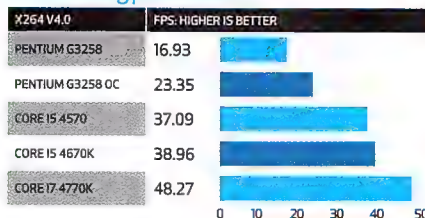
"With the hefty back catalogue of games that the PC can call its own, the G3258 is a fantastic budget gaming CPU."

LABS BENCHMARK RESULTS

Single-threaded performance



CPU encoding performance

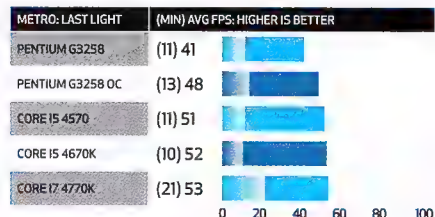
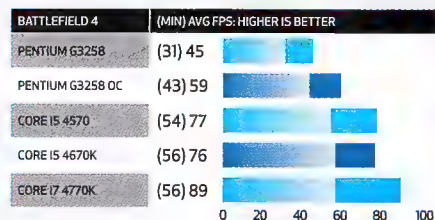
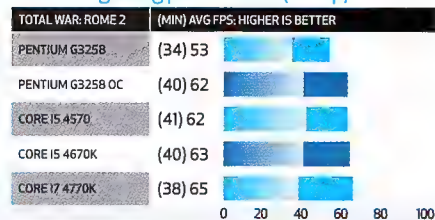


HAPPY ANNIVERSARY

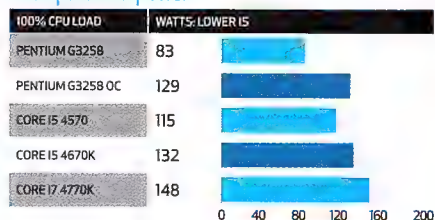
With the rock-solid 4.6GHz clock speed, the G3258 is suddenly able to post gaming performance pretty much on par with what the far more expensive Core i5 processors are capable of, and not far off what the supreme K-Series i7s can offer. In the vast majority of games you simply won't notice any difference in performance between a GPU being fed by the Pentium Anniversary and any of the higher-end Core processors.

DICE's Frostbite 3 engine is here to raise a cautionary finger, though. It's indicative of a (finally) growing trend in game engines to actually take advantage of all the threads available in a gaming PC's processor. That means that, even with such a hefty overclock, the G3258 is still a long way behind the four and eight threads of the Core i5 and i7 CPUs in our *Battlefield 4* benchmarks. In the future, the dual-core Pentium Anniversary will be

DirectX 11 gaming performance (1080p)



Peak platform power



you're into a situation where the cheaper chip is looking like a false economy given how much GPU performance you're sacrificing opting for the lower-end CPU. And in previous locked-down generations that would be that. Job done, story over. The budget chip would be too budget to really consider it a viable silicon alternative to a decent quad-core i5.

But that's not the whole story – this is Pentium anniversary party-time, and when you take advantage of the latent performance inside that unassuming CPU die the picture changes dramatically. Admittedly we did have a water-cooler strapped to the G3258 to see how far we could push it given ideal conditions, but it wasn't the temperature limits that stopped us pushing the clocks further.

Like pretty much every top-end Haswell CPU we've tried recently, the G3258 peaked at an impressive – and impressively cool – 4.6GHz. That's a huge amount of extra CPU power that's available with some very minor multiplier tweaking, and puts the single-threaded performance ahead of a stock-clocked i7-4770K. Because we're talking about two cores and two processing threads though, the multi-core performance still isn't stellar;

found wanting in titles optimised for multi-threading, and with the low-level APIs like Mantle and DirectX 12 promising even better multi-core support, that might happen sooner rather than later.

But right now, and with the hefty back catalogue of games that the PC can call its own, the G3258 is a fantastic budget gaming CPU. It's able to hold its own in the vast majority of titles, and deliver gaming performance that's barely distinguishable from that of far more expensive CPUs. AMD has had the budget end of the gaming market pretty well sewn up, but the Pentium Anniversary chip is going to form the basis of some outstanding bargain gaming PCs. ■ Dave James

Verdict

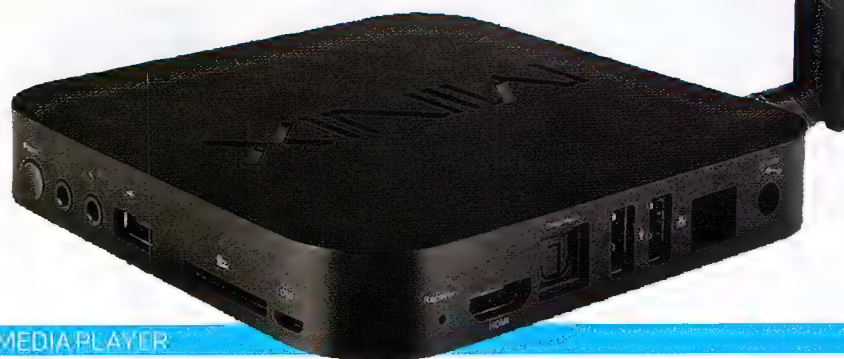
Features
Performance
Value



At stock speeds there's not a lot to recommend, but tweak the clocks and it becomes a winning slice of silicon.



"It's a nice example of what features we should be demanding as standard — but it needs a bit more work."



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Minix Neo X8-H

This Android-powered media player is full of promise, but sadly a bit short on delivery.

Every now and then, a product comes along that gives a glimmer of what could be. In the case of the Minix Neo X8-H, that's the future of using Android mini-PCs as streaming set-top boxes. The Minix isn't officially available in Australia yet, but that seemingly hasn't dampened local enthusiasm and you can import one for around \$170.

While the WD TV and Apple TV each certainly fulfil their audiences' needs, folks who crave better input controls and customisability may eventually find that they'll get their wish without having to shell out serious cash for a DIY HTPC build.

We had no better demonstration of this than when we first encountered the Neo X8-H's bundled remote. It has mushy buttons and must be pointed directly at the X8-H for input to register. So instead, we paired our Android Bluetooth keyboard and a Bluetooth mouse to the unit to dramatically increase our

speed and accuracy in navigating screens.

Free access to the Google Play Store also meant we could customise the content available on our Neo X8-H and gaining access to videos stored elsewhere on our network through the Android XBMC app was also a snap.

Besides flexibility, being built on Android OS offers much wider breadth than today's top-dog set-top boxes. The Neo X8-H's range of abilities encompasses editing documents, spreadsheets, and presentations via QuickOffice (which comes pre-installed), as well as functioning as your own portable hotspot. If you ever want to travel with this Minix, it could be handy for more reasons than just killing time via TV episodes or music.

But despite these features, extra goodies like 4K support, and its outer good looks — a satiny, lightly rubberised black finish and rounded edges that balance

out its surprisingly large external antenna — the Neo X8-H doesn't quite deliver as polished an experience as its competitors. Part of this isn't wholly the unit's fault: Due to the Android app landscape, some apps only have phone-screen optimised interfaces (which look a bit silly on a TV).

But the majority of the issue revolves around the Neo X8-H's own interface and selection of pre-installed software. Turn it on for the first time, and you'll have to go through the process of digging into settings and adding a Google account all on your own; there's no initial setup wizard to run you through it. Its main screen is a very basic, borderline-unattractive 10-foot UI that forces you to either organise shortcuts to Android apps in pre-set folders like "Video" and "Music," or litter the bottom edge with icons. And barely any apps come pre-installed; of the few notable ones included there's XBMC and QuickOffice.

Added to this clunkiness is just-passable performance. Despite posting higher numbers in our benchmark tests, streaming web video was heavily compressed (even when running it over a fat pipe) and emulated games played through the RetroArch app stuttered. In comparison, our first-generation Nexus 7 had smooth playback in both scenarios.

Still, it's a nice example of what features we should be demanding as standard — but it needs a bit more work before it can actually become that standard. ■ **Alaina Yee**

Verdict

Features
Performance
Value



Shows potential, but needs more polish and performance.



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"Transporter Sync turns out to be a no-brainer addition to the gear-that-pays-for-itself list."



NAS

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Transporter Sync

A low-cost way to run a personal Dropbox, without the privacy issues.

Going through the minor problems with Transporter Sync would be mean of us; but we're not here to be nice, we're here to be honest. We didn't like the UI graphics, and we'd prefer USB 3.0 support.

But apart from that, Transporter Sync turns out to be a no-brainer addition to the gear-that-pays-for-itself list.

The appliance itself is a small, black, conical frustum, with a wrap-around Cylonesque LED. You plug it in to an external USB hard drive (which alas, gets reformatted) and your ADSL router or Ethernet network, and then wait ten minutes while it sets itself up. During this time, you can visit the web site, create an account, and download the appropriate software to your weapon of choice (Mac,

Windows PC, iOS or Android device). Once the LED has settled to a steady blue, you nip back to your account and 'claim' the Transporter by giving it a name and clicking 'Next' a few times. That's it, you've got your own personal, and above all private, version of Dropbox.

For PC and Mac users, it's almost exactly the Dropbox experience. There's a Transporter folder into which you can load whatever data you'd usually keep on Dropbox — files, PDFs, 1Password keychains, photos, and so on. With the correct login and the software installed

on another computer, your Transporter syncs your files in the background. The files are stored on the Transporter — not in the cloud — and encrypted during transfer.

On iOS, it's *almost* the Dropbox experience: Transporter lacks the deep integration with third-party iOS device apps that the Dropbox API offers. Instead of being able to open a text file in, say, Byword directly from the Dropbox folder, you find the file in the Transport app, use 'Open In...' to open it in Byword, edit it, and then use 'Share...' and 'Open In...' to upload it using the Transporter app. Click it isn't. But it works.

So, question: if it's private, why do you need an online account? The Transporter account handles the network shenanigans the same way as FaceTime does, and manages the

shared folder function with other Transport users.

There's one final trick up the Transporter Sync's sleeve — anything stored in the Transporter Library sub-folder is stored on the Transporter device, but not on the client. That means larger files can remain accessible, without taking up valuable space on your precious iOS and Android devices. If you're looking for Dropbox-like remote access — and offsite backups without privacy issues — the Transporter Sync is ideal. ■ Richard Dyce



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

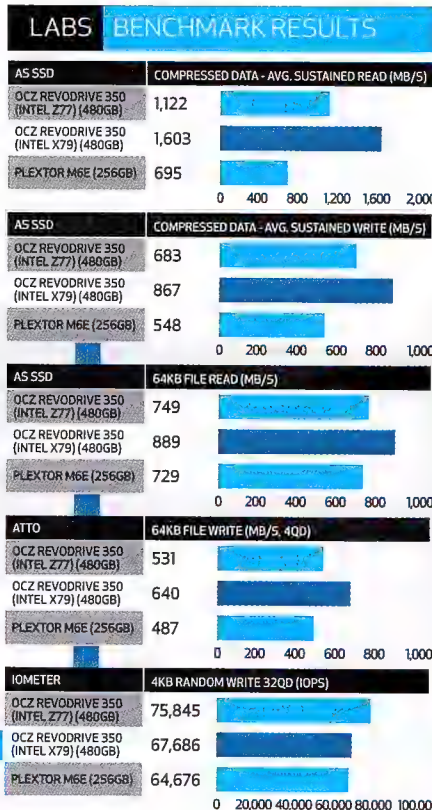
A solid, great-value option for creating your own private cloud-based storage.





PCIe SSD

\$1,030 | WWW.OCZ.COM



OCZ RevoDrive 350

Screaming SSD punishes benchmarks — and wallets.

The world of SSDs has reached a state of limbo. We're pretty much at the limit of current SATA technology, and SATA Express will be an evolution not revolution. If you really need some extra horsepower, where do you turn? The new M.2 slot promises up to 40% faster speeds than SATA, but we haven't seen anywhere near that yet. They're on the right track though, since the PCI Express bus they use has a lot of spare bandwidth, if it's not fully occupied with a video card. OCZ has known this for some time, as its new RevoDrive 350 is the latest entry to a long-running line of PCIe-based SSDs. OCZ's new drive offers speeds of up to 1,800MB/s, which is three to four times faster than a SATA-based SSD.

How is that possible? OCZ is running four devices in RAID 0 to achieve the 480GB capacity and the blistering speed. There are also 240GB and 960GB versions of this drive, but interestingly, the

240GB version's speed is cut in half since it uses two controllers rather than the four Sandforce SF-2282 drives that the 480GB version uses. For NAND fans, its 19nm MLC flash is rated to let you write 50GB a day for three years.

All this hardware doesn't come cheap — the 350 sports a whopping \$1,030 price tag. Since a standard 480GB SATA-based SSD is about a quarter of that, we have to wonder who might benefit the most from this drive.

Like conventional SSDs, it's not 1.8GB/s across the board. That's just for sequential reads and writes of large files; real-world usage is a mix of files from gigabytes to kilobytes. When it comes to files up to 32KB, the RevoDrive won't outstrip SATA speeds. It's not until 64KB that performance bests a SATA-based SSD. But since it hits 1.8GB/s at the 4GB file size, it's a superior choice for things such as HD video production or batch processing high-res photos. Someone who just wants a

nice SSD to boot Windows and load some games quickly will see negligible benefits.

The installation experience is much cleaner than a SATA drive. It doesn't need cables for power and data — all that goes through the motherboard's PCIe slot. So you just put it in, screw down the bracket, and turn on the computer. You will need to install drivers, though, whereas a SATA drive is recognized right away. The RevoDrive's lack of immediate recognition creates a hurdle if this is the primary drive of a freshly built PC, but Windows lets you add drivers during the OS install. You may also have to do some fiddling in the BIOS to get the Windows installer to see the drive properly, so the RevoDrive isn't positioned well for someone who's new to building PCs. Also, the secondary PCI Express slots on non-enthusiast boards usually max out at x4 PCIe 2.0, while this needs x8 to reach its advertised numbers.

We got some interesting benchmark results when we compared the numbers from our Z77-based Gigabyte motherboard to that of a system with an X79-based ASUS Rampage IV Extreme. The RevoDrive generally performed much better with the X79 chipset, though the gap closed in HD video encoding. This kind of variance isn't unusual for PCIe-based SSDs. The Plextor M6e also performed better on X79. To us, it seems like another reason to limit a PCIe storage device to specific roles. Hopefully, the upcoming NVM Express-based drives will be more consistent. ■ Tom McNamara

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

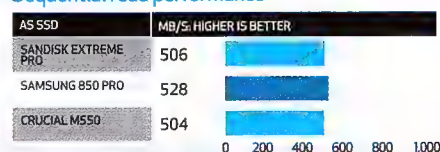
Warp drive velocity with easy installation, but a very high price tag and variable performance.



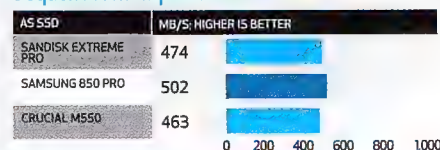


LABS BENCHMARK RESULTS

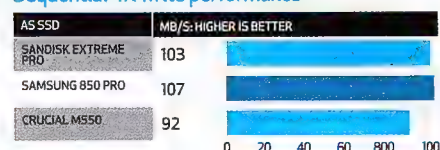
Sequential read performance



Sequential write performance



Sequential 4K write performance



SSD

\$399 | WWW.SANDISK.COM.AU

SanDisk Extreme Pro 480GB

Speedy, long-lived and relatively easy on the wallet. Kudos, SanDisk. Kudos.

SanDisk may not be the first name that springs to mind when you're thinking of high-end SSDs, but it's really making a name for itself at the moment. This is mostly because the Extreme Pro was the first consumer drive to arrive on the scene with a massive 10-year warranty behind it. Yup, SanDisk really is that confident about its drives lasting the distance.

It helps that, like Samsung, SanDisk is using its own memory chips to fill out its drive. That means it has a good idea of how those chips will perform and possibly more importantly, how long they're likely to last. This is probably what encouraged Samsung to come out and do the same thing with its shiny new 850 Pro drive.

SanDisk is using the same Marvell controller that Crucial used in its previous generation of SSDs. This is the older 9187 silicon rather than the newer 9189

that sits in the M550 and MX100 Crucial drives, but SanDisk has created its own firmware to help squeeze as much performance as possible from the sum of its parts.

And it's wrung a huge amount of goodness out of this high-capacity drive. Obviously we're still operating under the traditional SATA interface limitations, so SanDisk is quoting read and write speeds of just above the 500MB/s mark. Our ATTO sequential numbers bear that out, coming in at 554MB/s and 520MB/s for reads and writes respectively.

That drops off with the incompressible data tests in AS SSD, but it's still the quickest Marvell-based SSD we've tested, with only Samsung's 840 Pro and 850 Pro drives able to achieve better numbers. And both those drives cost considerably more than the \$399 of this SanDisk SSD.

While the sequential numbers are impressive, the

more relevant day-to-day figures in the 4K random read/write tests make better reading. In those benchmarks only the brand-new 850 Pro is capable of offering better random numbers, making the Extreme Pro one of the most responsive SSDs we've ever tested. But synthetic numbers are only part of the picture; we also need to see the real-world performance backing those impressive figures up. Thankfully, they do. The ZIP compression speed is really impressive.

This is all boding rather well for SanDisk, isn't it? And it doesn't stop at the basic performance level either, with the drive's second-generation nCache technology using some speedier SLC NAND alongside the main bulk of the MLC NAND making up the rest of its capacity.

This is similar in approach to Samsung's TurboWrite, but uses far less SLC. SanDisk has also created the SSD Dashboard software to keep you and your drive

up to date. It offers firmware upgrades and monitoring tools that will tell you how quickly your drive is performing and, depressingly, how long it has left to live. Just to remind you of its mortality...

■ Dave James

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A high performance and reasonably priced solid-state drive, with the potential for a very long life indeed.



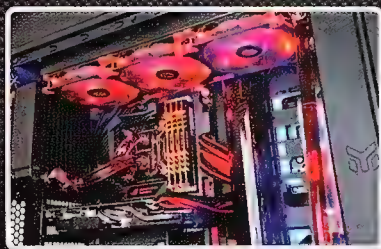
CORE V71

not just a pretty case...



...it has the features to back it up too

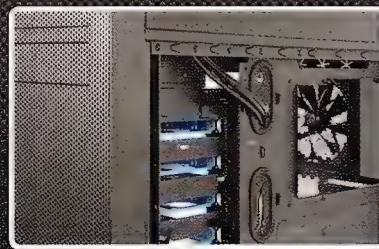
Water Cooling Capability



Modular HDD Rack



Cable Management



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"You could say that the TrackIR is almost the poor man's Rift in terms of immersion, but that would be doing a disservice to the work NaturalPoint has put into it, as well as redefining the term 'poor man.'"

GAMING PERIPHERAL
\$175 | WWW.NATURALPOINT.COM/

NaturalPoint TrackIR 5

Keeping track of gaming immersion since 2009.

We'll admit, Natural Point's TrackIR 5 Pro is nothing new. That's because it's been around since 2009, when we reviewed this "latest" iteration of the head-tracking sensor. It's a testament to the quality of the TrackIR that now, five years later, it's still a genuinely game-changing peripheral. Its only problem is that the price hasn't dropped since then.

The Oculus Rift is praised for delivering immersive gaming, but the TrackIR has been quietly putting you further into the game for years. In fact, the latest Oculus Rift (DK2) has just added a similar positional-tracking system to its own arsenal. You could say that the TrackIR is almost the poor man's Rift in terms of immersion, but that would be doing a disservice to the work NaturalPoint has put into it, as well as redefining the term "poor man."

The TrackIR works with a high-speed infrared camera

sitting atop your monitor, tracking the relative position of your head. It does this using either a set of reflectors on the standard, hat-mounted TrackClip, or the USB-powered LEDs of the headset-mounted TrackClip Pro. It has six degrees of freedom, tracking a full range of movement of your noggin. It's the way that's translated into your games that is the smart part, though.

You're still looking at a fixed viewpoint — your monitor — but as the TrackIR precisely follows the movement of your head, it also amplifies it in-game. That means a slight turn of your head will move the game camera much further on screen. That might sound unwieldy, but the accuracy and consistency of the TrackIR makes it all incredibly intuitive, and it doesn't take long before you're naturally tracking things in the compatible game worlds you choose.

It doesn't work for all games, but in the ones that it

does you'll wonder what you ever did without it. We can barely imagine playing *Elite: Dangerous* without being able to track targets around our cockpit, and in Bohemia's *Arma* series and *DayZ*, the extra awareness of your situation is a major advantage.

The tough bit, as we mentioned earlier, is that some five years down the line, the Pro package is still the same price it was at launch. This is the package you want though, as it comes with the LED TrackClip Pro and means you don't need to wear a fashion faux-pas baseball cap to support the reflective TrackClip. It's a lot of money for a gaming gadget, but unlike others, the TrackIR is genuinely useful. It's also half the price of an Oculus Rift, and has the benefit of letting you still see your controllers, take a drink when you want, and use the beautiful high-res monitor you paid good money for.

You won't get the same level of immersion, but you

will definitely get a big step up in the games it supports.

The TrackIR is definitely one for the sim-heads rather than the *BF4* crew, but in racing games, flight sims, space sims, and serious military shooters, it's pretty much a must-have peripheral. You might call head-tracking a gimmick, but only until you actually use it in-game. ■ Dave James

Verdict

Features	★★★★☆
Performance	★★★★☆
Value	★★★★☆

Seriously ups immersion; easy to use; pricey.





GAMING MOUSE

\$59 | WWW.CORSAIR.COM

Corsair Raptor M45

Wherever you stand on optical vs laser, Corsair has you covered.

We'd assumed the point of the Raptor range was to offer low-cost versions of the Vengeance range. But this Raptor M45 has confused us – it's not that 'budget'.

The M45 is the same price as the excellent Vengeance M65 laser mouse. Yet the M45 has a lower-sensitivity optical mouse sensor, a plastic chassis and fewer buttons. Ordinarily, that would be a source of confusion. The decision between the two is actually more down to personal preference than raw technical details. If talking about straight numerals, the max 5,000dpi of the PixArt optical sensor in the M45 is a long way behind the M65's 8,200dpi laser sensor, but it's not an apples comparison. There are many who will side with the optical sensor – for fast-paced gaming they can be more accurate than laser, as long as you have a good mouse-pad. But the M45's optical sensor is an impressively reliable option.

I didn't feel any twitchiness at its highest 5,000dpi setting. The Corsair mouse design is still one of the most comfortable and simple around. We're fans of the ultra-ergonomic Ballista MK-1, but the M-series are more accommodating for different grips and hand sizes. The M45's plastic body does make it lighter, which again is a preference of some serious gamers. There are three weights in the base, however, so you can make it even lighter still.

We can understand why this optical Raptor mouse is retailing for the same cash as the laser Vengeance. It's all down to preference, as both are excellent. You'd have to look a long way to find one that can better this.

■ Dave James

Verdict

A great quality optical gaming mouse, perfect for those who find laser mice a little too twitchy.



✓✓✓
apc
RECOMMENDS

PC CASE

\$245 | WWW.CORSAIR.COM

Corsair Graphite 760T

They call it Arctic White.
We call it Stormtrooper Chic

This month, the latest Corsair chassis has been polarising the APC team. Mostly, the arguments have been down to the aesthetic: from the angular look, right down to sharp feet at its base. But it's that full window design that's seriously split opinion.

Having that wide strip of Perspex neatly displays the LED-lit graphics cards, cooling fans and inner workings. The nay-sayers are mostly put off because it feels too showy. The 5.25-inch bays are surrounded by some rather cheap-feeling plastic that lacks the style of the previous chassis' visage. There is something that all of us can agree on, though: this is one beautiful chassis to build a PC into. If you don't need both 3.5-inch bays you can simply rip one out. In fact, if you're making the move wholesale to SSDs, then you could rip out both and rely on the vertical 2.5-inch bays on the back of the chassis. We are a little disappointed that the

5.25-inch bays have been riveted in, we'd like the option to strip those out too. It's not like you need extra space for your cabling, though. There's an enormous compartment behind the motherboard plate to route your sprawling power cables. There's also a massive cut-out in the backing plate behind the motherboard's CPU socket to make it easier to mess around with your cooler's bracket. It comes with a pair of chunky 140mm fans in front and a 140mm fan on the rear. The slight upgrade on the fans is welcome as it should aid in keeping the chassis quiet and cool. We've definitely still got bit of a soft spot for the previous 600T, but there is a lot to love in the 760T too. ■ Dave James

Verdict

The polarising Perspex side panel will either sink or float your boat. On the whole, we're massive fans.





Strix Pro Gaming Headset specs

60mm 32ohm Drivers
20Hz - 20kHz
Frequency Response
Ear Cups: 110 - 130mm
Braided Fibre Cable
Detachable Microphone
Active Noise Cancellation
Weight: 320g

The Strix Pro combines a stylish design with precision audio for the ultimate gaming experience.

ADVERTISING FEATURE

MAXIMISE YOUR ENTERTAINMENT WITH ASUS STRIX

PC gaming gear crafted to create the ultimate interactive experience.



For more information on the Strix Pro, scan in the QR code at left on your smartphone or tablet, or visit www.asus.com/Gaming/STRIX_PRO/

Taken from ancient Roman legends and the Greek word for owl, Strix means the keenest hearing and the sharpest eyesight. Strix means being at one with your environment, able to detect and react to the slightest movement. Strix means survival on pure instinct. Strix is in every gamer's blood and means the ultimate gaming experience.

ASUS Strix Pro Gaming Headset

UNLEASH YOUR GAMING INSTINCTS

The Strix Pro headset uses the latest technologies to give an extra competitive edge and make gaming an intuitive, effortless experience. Strix is also about style – a statement to the world that your gear looks as good as your gameplay. With precision audio, active noise cancellation, cross platform support and a travel friendly design,

the Strix Pro is a gaming headset like no other.

THE STRIX PRO DNA

For total control, the Strix Pro includes a USB powered inline control box that plugs between your computer and the headset. Sitting it on your desk makes it easy to instantly adjust the volume and plug and unplug your headset without getting behind your PC. It also gives a total cable length of 2.7m for easy installation. In an effort to cut out any distractions and maximise gaming focus, the Strix Pro control box features active noise cancellation technology. From yelling team mates to noisy mechanical keyboards, Strix can cut out more than 90% of environmental noise. Its lab tested too, using the control box to sample ambient sounds then counter them on the go. Conventional headsets use a 4 pole audio connector that has a single ground wire. Instead, the Strix Pro uses a 5 pole connector with dual

ground wires to reduce interference and eliminate potential cross talk.

Not just for PC gamers, the Strix Pro can be used with your Mac or PlayStation 4. You can also use the Strix for gaming or listening to music on your smartphone, tablet or MP3 player thanks to the included mobile adaptors.

PRECISION AUDIO

Buried inside the Strix Pro Gaming headset are two huge 60mm drivers using rare earth neodymium magnets. These oversize drivers mean you get punchy bass with plenty of low down kick without sacrificing any of the rich, immersive soundscape from the mid and high range frequencies. The headset has a 32 ohm impedance, a wide 20 - 20,000 Hz frequency response and an excellent 98 dB sensitivity. The unidirectional microphone has been designed to give clear in game communications, with a 50 - 16,000 Hz frequency response and a -40 +- 3dB

sensitivity. In other words, great sound quality whether you're listening or speaking.

UNIQUE DESIGN

Sound quality is important, but the ergonomic shape of the Strix Pro goes beyond functionality to give a design that is stylish yet will stand out at your next LAN. Importantly for epic gaming sessions, ASUS has used feedback from gamers worldwide to fine tune the clamping force of the headset so it is both secure yet comfortable. The removable and replaceable super-sized ear cushions conform to the shape of your head and are made from acoustic materials to block outside sounds and contain your gaming audio.

Using ASUS Flexion technology, the microphone arm is built from moulded rubber that gives a strong yet flexible and stylish design. It's also removable if you want to use the headset just for music.

For those who like to travel, the foldable ear cups can lay flat, protecting them

For more information on the Strix GTX780, scan in the QR code below on your smartphone or tablet, or visit www.asus.com/au/Graphics_Cards/STRIXGTX780OC6GD5/



The Strix GTX780 has 6GB of GDDR5 and a boosted GPU clock speed for the best performance.

ASUS Strix GTX780 6GB specs

NVIDIA GeForce GTX 780
6GB 6008MHz GDDR5
GPU Boost Clock: 941MHz
2304 CUDA Cores
384-bit memory interface
1x DVI Dual-link DVI-I
1x Dual-link DVI-D
1x HDMI output
1x DisplayPort
PCI Express 3.0

Using the DirectCU II thermal design and DIGI+ VRM, the Strix GTX780 runs cool and quiet.

from damage and making them easy to pack in your LAN bag. The braided fibre cord reduces tangles while protecting the cables from damage.

THE RESEARCH

ASUS boffins put the Strix Pro through a battery of tests in an IEA ISO Anechoic Chamber, using a test head and a sine wave generator sound source. Both total harmonic distortion and frequency response were tested to ensure optimal sound in all situations. The harmonic distortion is very low, which is critical in providing the clean, crisp distortion free sound needed to experience the smallest sound details that can be the difference between winning and losing.

The Strix frequency response is very even across the entire range, letting you hear the sound exactly as the game developer intended. It also means the headset is great for listening to music too.

ASUS Strix GTX780 6GB

INCREDIBLE GAMING PERFORMANCE

Precision peripherals are critical for the ultimate gaming experience, but you also need top notch hardware. Strix means the sharpest eyesight for epic and smooth games – in other words, detailed 4K gaming with the fastest possible frame rates. The ASUS Strix GTX780 6GB uses the latest technology to truly maximise your entertainment.

GAME FASTER

The Strix GTX780 comes already pushed to the limit, with a boosted GPU clock speed, 6GB of GDDR5 and a DirectCU II technology cooler. The results are impressive, with a GPU that is totally future proofed for 4K gaming yet also stays quiet and cool. Running *Battlefield 4* at 3,840 x 2,160 with 4x MSAA and details set to high, the Strix GTX780 averages 45.6 fps – 15% faster than the reference design. *Metro*

Last Light is a graphically intense game, especially at 4K resolutions – yet the Strix is 7.9% faster than the reference GTX780. No matter your game of choice, the Strix name means you will always get the very best performance.

SILENCE IS GOLDEN

To tame the heat of the powerful GPU core, the Strix GTX780 uses a DirectCU II cooler. Featuring 10mm heat pipes with 40% greater heat transfer ability and 2x the heatsink fin area, the Strix card runs 38% cooler than the reference GTX780 under load. It also has a chunky back plate that further aids heat dissipation and lowers temperatures. The optimised design and large fans means the Strix 780GTX is an impressive 3x quieter than the reference design. Even better, Strix brings absolute silence when playing less graphically intense titles, such as *StarCraft 2* or *League of Legends*. When the GPU is under 65°C the fans actually stop, letting you focus entirely on your gaming.

TECHNOLOGICAL SUPERIORITY

To ensure rock solid gaming, the Strix GTX780 uses 10 Phase Super Alloy Power to improve performance over the reference design. In charge is the DIGI+ VRM digital voltage regulator that gives a 15% improvement in power efficiency. The precision control reduces power noise, which gives more overclocking headroom yet a 30% increase in stability. The Strix GPU also uses hardened components for a 2.5x extended lifespan and the highest levels of reliability. The Strix GTX780 includes GPU Tweak – powerful software that lets you perform real time overclocking as well as monitor temperatures and power use. You can also use GPU Tweak to easily live stream your gaming sessions over the internet.

KEEP AN EYE OPEN, AS MORE EXCITING ASUS STRIX PRODUCTS ARE COMING SOON!

software

» APPS FOR ALL THE PLATFORMS EDITED BY PETER DOCKRILL



Windows » SOFTWARE

Scribd

Access to 400,000 books for a monthly charge.

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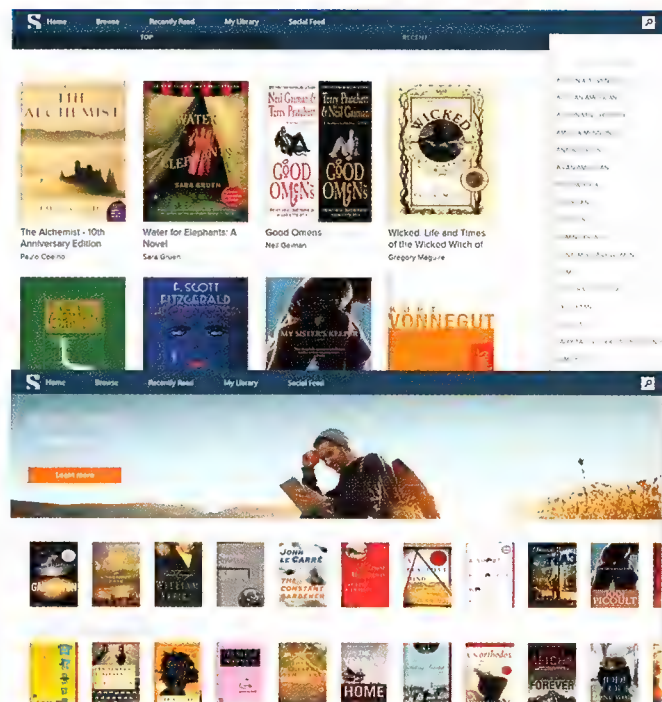


We're in the midst of a transitional period where all sorts of content that was previously only available if you purchased it outright is now becoming accessible via subscription channels.

You can see it with music streaming providers (such as Spotify), movies and TV services (like Netflix, which is imminently expected in Australia), computer software (Adobe's Creative Cloud) and even video games, with outlets like PlayStation Plus and EA Access giving gamers access for a monthly fee.

And now we're seeing the same concept inevitably extend to books, although, as with all the other mediums thus far, securing subscription access in Australia requires satisfying all the various rights holders first. This is the reason some of the more prominent book services, like Oyster and Amazon's recently announced Kindle Unlimited, aren't yet on offer locally. One provider that is, however, is Scribd, which you can access from the web, on iOS or Android, or in this handy Windows 8 app.

Scribd serves up digital access to more than 400,000 books from some 900 publishers for a monthly charge (with titles additionally available for purchase). The caveat is that not every publisher is on board — with even fewer titles available in Australia due to territorial publishing restrictions — meaning there are inevitably large gaps in the collection, but in our

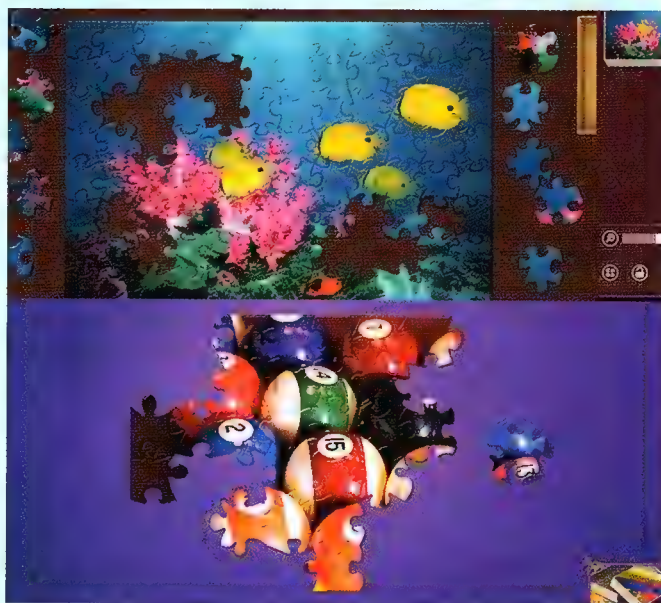


browsing through the Scribd catalogue we still found lots of contemporary titles begging to be dipped into, plus the inevitable slew of out-of-copyright classics. If you're interested in sampling an all-you-can-eat books service, Scribd's free trial is certainly worthy of consideration (you're obliged to provide your credit card details when you sign up, so don't forget to cancel your subscription during the trial period if you decide it's not for you).

Microsoft Jigsaw

FREE WITH ADS/\$1.49 MONTHLY/\$9.99 YEARLY | [MICROSOFT STUDIOS | TINYURL.COM/PKVQZE4](http://MICROSOFTSTUDIOS.TINYURL.COM/PKVQZE4)

Jigsaws might be the board game equivalent of looking for a needle in a haystack, but they're a pleasurable enough way to kill some time if that's what you're into — and there's an undeniable sense of achievement when you place that final piece (even if the only thing you really achieved was tidying up a mess of cardboard). Microsoft's new digital adaptation of the classic puzzle is a bit of a mixed bag, however. While you can't fault Microsoft Jigsaw for content — there are hundreds of puzzles available, a number of different game modes and a range of difficulty levels — we were amazed to find advertising strewn throughout the app, including banners and pop-up videos, with the Windows maker attempting to extort a monthly or yearly subscription to upgrade to "Jigsaw Premium". We live in a world where Apple changed the software rules by freely giving its annual Mac OS upgrade away at no cost, and yet Microsoft still wants users to fork out for something as piddling as a jigsaw game subscription? Badly handled, that's for sure.





Mac » APPS

Reeder 2

Another RSS client rises from the ashes of the Google Reader fallout.

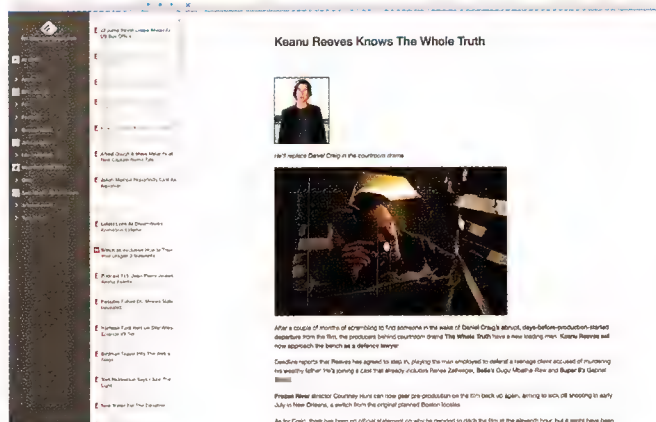
\$12.99 | SILVIO RIZZI | REEDERAPP.COM



When Google shuttered its online Reader service, it inadvertently broke a number of apps that depended on its RSS backend. Reeder was one such app, but an iOS version followed with support for other RSS services. But Mac Reeder users had to be patient for a comparable update. And now it's here...

The obvious change is Reeder's support for multiple services: Feedbin, Feedly, Feed Wrangler, Fever and Readability all feature, as does support for local RSS, although the latter doesn't sync across platforms.

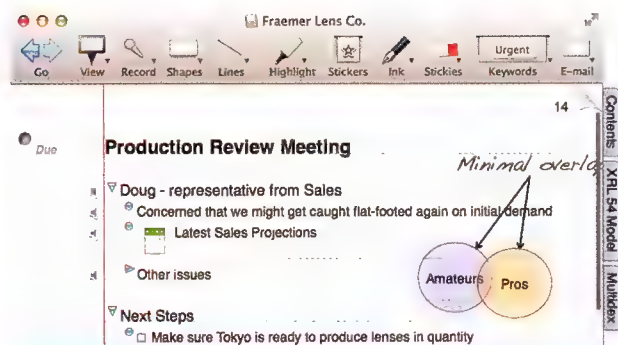
Aside from that caveat, users of Reeder 2 on iOS should feel at home. Subtle design changes introduce a flatter, cleaner, more Ive-like interface all round, while cascading panes benefit from smooth transitions that make the act of drilling down into your feeds smooth. As before, switching between unread, starred and all items is a one-click affair, and now you can assign specific trackpad gestures and



keyboard shortcuts to these actions to suit, making perusing and organising feeds easier.

Like its iOS companion, Reeder 2 offers a cartload of sharing options through a drop-down located above the viewed article, including Facebook, Messages, Twitter, Mail, Readability, Evernote and more.

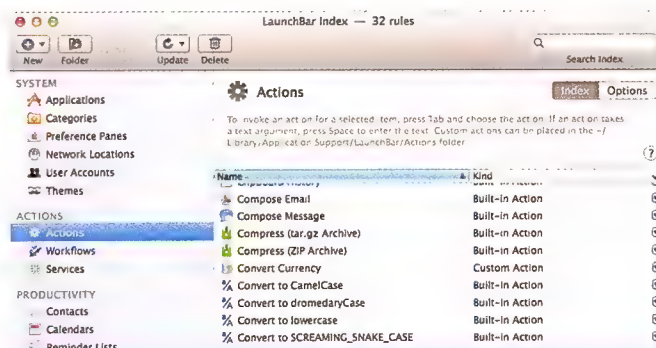
Existing Reeder licence owners may balk at the \$13 outlay, but that's the cost of cross-platform sync. For everyone else, there's ReadKit 2, which offers more features and wider RSS support. Tim Hardwick



NoteBook 4 for Mac

\$74.99 | CIRCUS PONIES SOFTWARE | CIRCUSPONIES.COM

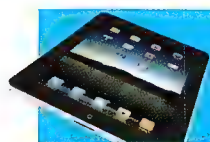
This app faithfully recreates the experience of using traditional ruled notebook paper in electronic form. Although it offers plenty of convenient formatting shortcuts, it can also handle to-do lists, image or audio files, bits clipped from web sites and much more. Handwriting recognition has been added, and the app can sync to Dropbox. NoteBook 4 finally adds 64-bit processor and Retina display support. It also features a streamlined user interface. The Clip and Annotate panel has returned, a neat addition that allows users to make tweaks and even strip formatting from copied text prior to pasting it. There's little to complain about, although the ever-growing number of features might overwhelm novice users. And there's still no iCloud support as yet. JR Bookwalter



LaunchBar 6

FREE TRIAL; FULL VERSION, €24 | OBJECTIVE DEVELOPMENT | OBDEV.AT/PRODUCTS/LAUNCHBAR

LaunchBar is essentially 'Spotlight Pro', enabling you to search your Mac and perform actions on found objects. Along with improved file indexing, more rules exist, providing access to Reminders lists, Emoji, Finder tags, and Safari's iCloud tabs, Top Sites and Reading List. The Reminders functionality is strong, you can avoid Apple's app entirely. The other big win is the new live results. These occur as you add to Calendar and Reminders, but also when searching Google and Wikipedia. Power users also get excellent new toys. Selected items offer all kinds of details when browsed. Elsewhere, custom actions can be created and installed. Alfred still has the edge on usability, but LaunchBar is faster. Both obliterate Spotlight.



App Store » iOS APPS

Stackables for iPad

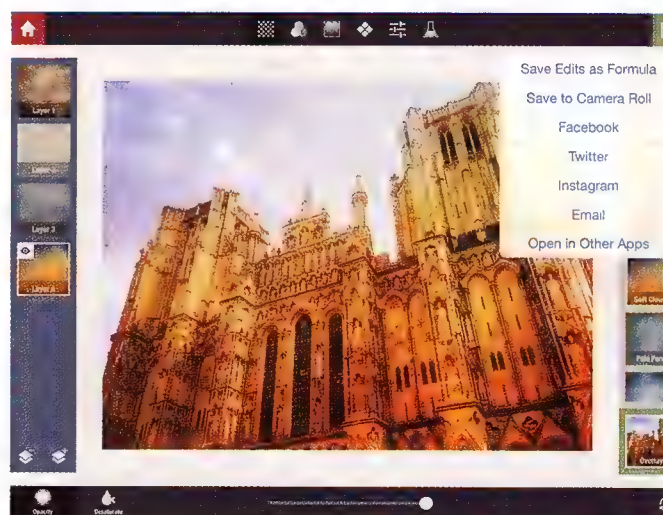
Layer it up for better vintage shots.

\$1.29 | SAMER AZZAM | APPSTORE.COM/SAMERAZZAM



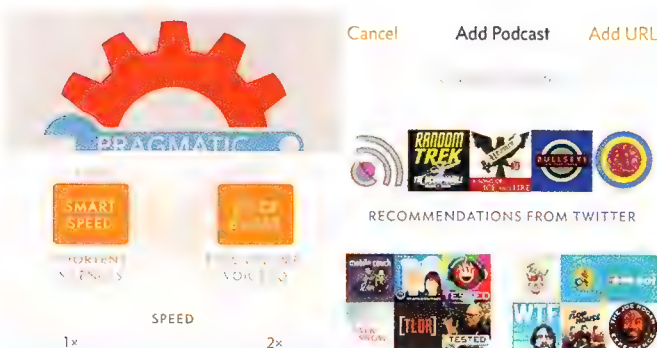
Stackables was first available on the iPhone, where it offered a powerful way to blend vintage effects and pull off looks that would normally require the full version of Photoshop. And now, on iPad, this version gives you a greater canvas to work with, plus it seems a more natural fit in landscape orientation than apps such as iPhoto, for instance. Traditional filter apps, even when offering slider tweaks, don't always hit the spot. Stackables gives you almost-endless customisation options as you add/remove layers, reorder them and change various parameters – contrast, saturation, brightness, exposure, shadows/highlights and more. In fact, there are more than 20 adjustment tools. There are over 150 effects on offer, too, and these can be applied quickly, even when piling up the layers to produce ever-more complex effects.

The interface puts your image at the centre of the action, with balanced sides for the layers/effects (left/right) and



tools top and bottom. Just choose a filter option from the top, tap the effect on the right and when you want to add an overlay tap the + in the bottom left. The layers on the left can also be hidden rather than removed, to see what your photo looks like without them, and by tapping and holding, you can reorder layers in the left column for a different result. With so many ways to make new effects and a sizeable gallery of ready-to-go blends, Stackables is a winning formula for iPad users.

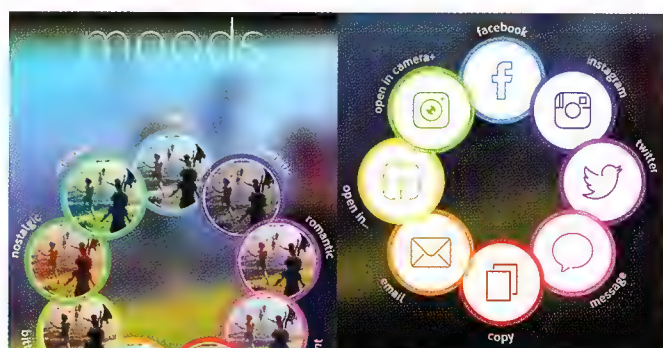
Christian Hall



Overcast: Podcast Player

FREE | OVERCAST RADIO | OVERCAST.FM

This iPhone podcast app is all about ease: finding streams to follow is simple, and there are features that make them easier to listen to. The search function found every podcast we tested it with, and once added, new episodes download to your device over Wi-Fi, or 3G/4G if you unlock that function via a \$4.99 'Unlock Everything' IAP. The IAP also unlocks options for playback, and the full range lets you adjust the playback speed between 1x and 2x speeds while keeping the pitch of voices normal, along with a voice boosting option that makes speech stronger. The Smart Speed option removes sections of silence, but can ruin comedy or dramatic timing. Overcast is missing a couple of features (direct streaming being one), but it's already a superb standalone podcast app. Matt Bolton



MagiCam

\$1.29 | TAP TAP TAP | TAPTAPTAP.COM

MagiCam is a super simple camera app from the folks behind Camera+, arguably the best photography app on iOS. While Camera+ is all about control, MagiCam is about getting fun results quickly. Take a snap and it's automatically adjusted using similar magic to Camera+, then you can share it. That's about it. You can choose to take a photo that's square or rectangular, and you can apply different 'mood' filters, which appear to be slight colour casts, rather than more interesting or elaborate effects. There's no focus control or anything like that. Everything is easy, and photos generally look good, but it feels a bit like a solution without a problem. The iOS Camera app is simple enough, and people who care about improving their photos are better off just grabbing Camera+. Matt Bolton

A photograph of a man surfing on a wave. He is wearing a dark wetsuit top and patterned shorts. He is leaning forward, riding the wave. The photo is set within a red border that has a white corner cutout on the right side.

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Instagram

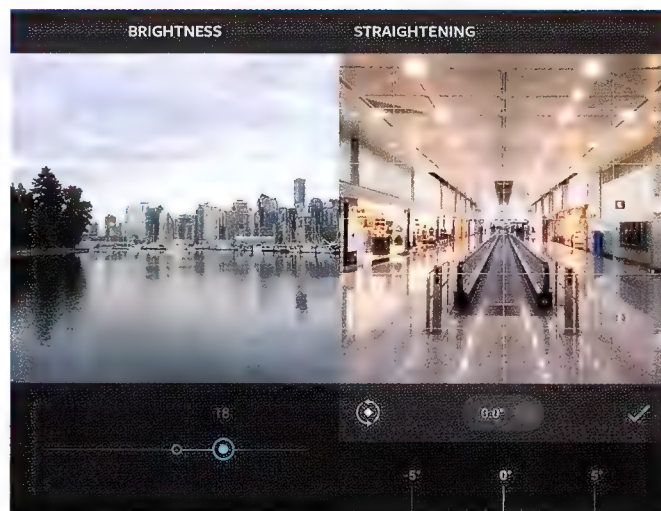
The popular photo-sharing app gets a little more sophisticated.

FREE | INSTAGRAM | TINYURL.COM/BOV5NQ2

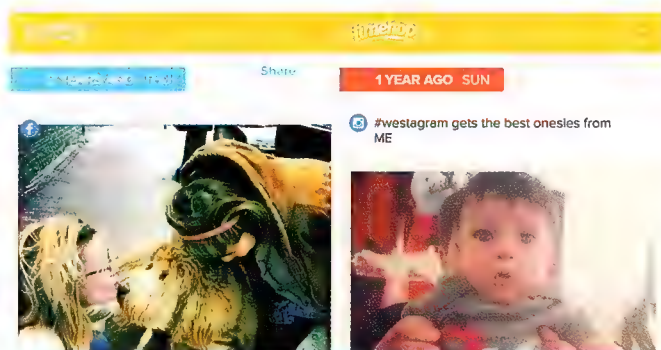


Part of the appeal with using Instagram has always been its simplicity: snap a shot, apply a filter (or not) and share it with your pals. That's pretty much it. Sure, you could also dabble in a little light photo editing if you wanted — with tilt-shift effects, cropping and straightening, plus the 'Lux' silver bullet (that tends to either save photos or ruin them) — but at its heart the app embodied less-is-more thinking, trying to get out of your way with a minimal interface that put the focus on sharing first and foremost. With time, we've seen that less-is-more approach give way a little, as the developers (who now work for the Facebook mothership) scramble to add new features to maintain Instagram's growth and relevance. We saw it with the addition of video support last year, and we're seeing it again now with version 6.0, with a new range of manual photo-editing features that put more control in the hands of users.

Filters like Valencia, Lo-Fi and Sutro aren't binary absolutes



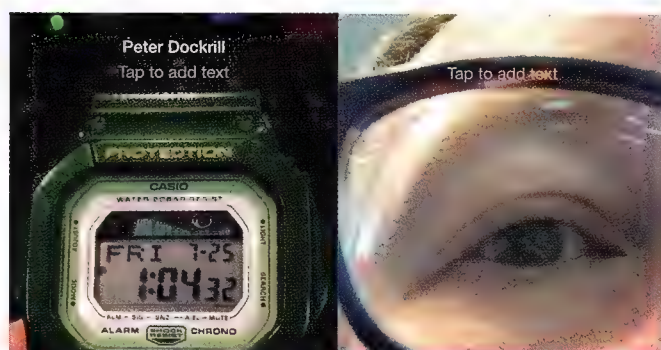
any more — instead the intensity of each can be controlled via a gradual slider button, as can the Lux effect itself, and users gain similar power over brightness, contrast, warmth, saturation, highlights, shadows, vignettes and an image sharpener. Compared to some of the more sophisticated mobile photo-editing apps available, Instagram's new inclusions are still fairly light, but they're nonetheless a welcome upgrade which gives people a lot more say in how their images are presented — and should result in a subtler network overall, with less hospital-grade fluoro-toned hipsterism. And next for Instagram? Not a new feature, but a necessary evil to help Facebook pay the bills: yep, advertising will start appearing in Australian feeds sometime in the next few months. Sigh, nothing's free forever.



Timehop

FREE | TIMEHOP | TINYURL.COM/QXYEQ25

Believe it or not, next year is the year Marty McFly supposedly arrives in future Hill Valley, and while time-travelling DeLoreans still aren't readily available (not to mention hover boards), Timehop might just be the next best thing. Providing a daily fix of ready-made nostalgia, the app shows you what you were up to exactly a year ago (and two years ago, three years ago etc), revealing any photos or posts you made on this date through history. It's not limited to just Facebook, with optional support for Google+, Twitter, Instagram and Foursquare (plus your device's photo gallery). A trip down memory lane is assured — provided you're an active user of the core services. Otherwise Timehop's rose-tinted memories could be a bit of a ghost town.



Slingshot

FREE | FACEBOOK | TINYURL.COM/LNVQRC6

For every killer app that takes the world by storm, there's a dozen pale imitations trying to hustle in on the action. In this case, Slingshot is clearly aping Snapshot's self-destructing photo-sharing schtick, albeit with a twist: take a photo or shoot a video (with optional doodling on top of), and then send it to your friends, but the kicker is they can't see what you've sent them until they volunteer to send something back. It's an interesting idea and one which makes content sharing more of a communal pass-the-parcel type game, but we don't see anything world-changing this time around.



Windows Store » WIN PHONE 8

Climatology

All of the weather, all of the time.

FREE | MICROSOFT RESEARCH | TINYURL.COM/MYQZDEC



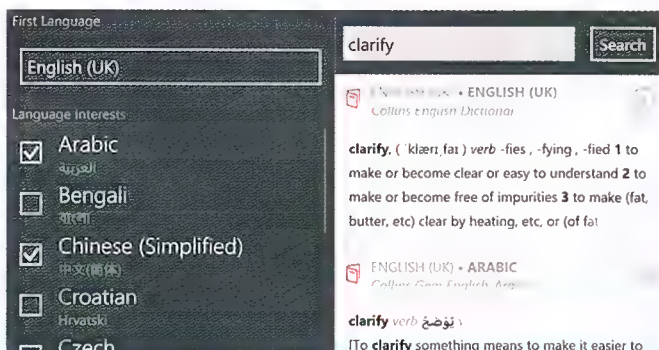
It says something about our expectations of mobile apps these days that an effort like Climatology, developed by Microsoft's research wing, can be released to such collective indifference. Yes, it's minimal — seemingly polarisingly so, according to its fairly dismal reception around the web — but it's also a practical, useful source of global historical climate data that you can carry around with you in your pocket.

The idea is simple: Climatology can estimate for you what the weather will be like, for any location on earth, at any given time of the year. Users navigate via a Bing Maps interface; you can scroll and zoom to any latitude or longitude and set a slider for any month of the year, and Climatology will show the average high temperature for the month, along with the average number of rain days and average amount of sunshine per day. Microsoft bills the app as something useful for travellers, holiday and wedding planners and so on, but it's also potentially of interest for students and those just curious about weather around the world.

Not that we loved everything about Climatology, mind you. On startup the app always defaults to India — now it just happens



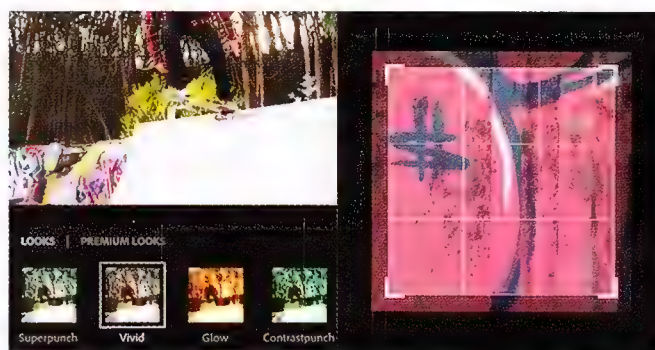
that Windows Phone is mighty popular in India, but it'd make a lot more sense to display the user's current location. Also, it's not clear where Climatology gets its meteorological data from, but the implementation isn't always consistent: for some locations we tested, data was inaccurate or seemed to display incorrectly. Still, Climatology's laid a good foundation for a unique weather app here, even if the focus is pointedly narrow. And in a show of faith that Microsoft isn't snubbing Google — although the converse can't always be said — inquisitive Android climate researchers will find Climatology available on their chosen platform too.



Clarify

FREE | CLARIFY | TINYURL.COM/OBE66ZR

One dictionary to rule them all? Looks like it. Clarify shoehorns 30 languages into one convenient app portal, supposedly incorporating the resources of some 670 dictionaries in total. After the obligatory sign-up, you simply set the languages that interest you, enter your search term and presto: Clarify provides the definition in two seconds flat along with the translations in whichever tongues you elected. That 2MB install size gives the game away, sadly; yep, you'll need a constant internet connection, otherwise Clarify won't translate squat. Since Clarify is most likely to be of use to travellers, that restriction could pose a bit of a problem.



Adobe Photoshop Express

FREE | ADOBE | TINYURL.COM/K5P57TF

The perennial Adobe freebie, Photoshop Express has graced just about every platform there is, and now it's Windows Phone's turn. While it's a decidedly barebones app — especially compared to Adobe's high-end mobile offering, Photoshop Touch, not yet on Windows Phone — the truth is that Photoshop Express probably includes everything most people need for 99.9% of simple photo retouching: oodles of filters, image adjusters (contrast, temperature, highlights, shadows etc), borders, cropping, red-eye reduction, auto-fix and undo. You won't find any full manipulation tools, but Photoshop Express has plenty to like. What we do object to however are the IAP (eg. extra filters) that are irritatingly dangled in front of your face. ■

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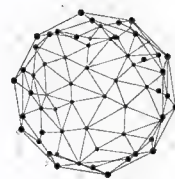
superguide » forging future tech



BUILDING A STRONGER
TOMORROW

FORGING FUTURE TECH

UNCOVERED: THE APPROACHING REVOLUTIONS SET TO ROCK GAMES, MOVIES, ROBOTICS & AI, AUTOMOTIVE, WEARABLE AND 3D-PRINTING TECH IN AUSTRALIA – AND HOW YOU CAN GET INVOLVED!



Computing has, without a doubt, driven innovation in many long-established industries – and it's creating new ones even as we speak. In fact, the influence of the microprocessor and the app has become so far-reaching that, this month, we thought it was about time to take a broader look at the most interesting areas of tech, and also seek out the opinions of local experts on the challenges and changes that are coming to these industries (or in some cases, already well in progress).

It's worth re-iterating, too, that a lot of technological innovation is actually happening right in our own back yards. Though Australia may be small in size, we're often world leaders in both science and tech. When it comes to the likes of films, for example, a search for the work produced by Australian studios contains some surprisingly noteworthy names – among them recent hits including *The LEGO Movie* and *X-Men: Days of Future Past*, which Sydney-based Animal Logic (best known for *Happy Feet*) contributed effects work to.

Australia's participation in the worldwide tech scene extends beyond just entertainment, of course, with local firms and universities contributing to fields like robotics, artificial intelligence, 3D printing and many other emerging fields.

And of course, it's not just professionals who are driving change in many of these areas. The ongoing 'democratisation of technology' – where low-cost software, computing platforms and off-the-shelf components are starting to allow almost anyone to build and create innovative software and hardware – means that hobbyists can also have deep and lasting effects in these areas.

With that in mind, as an appendix to each story, we've also dug into how you, personally, can get involved and participate in these fields – whether that's seeking a job or just looking to do it on the side in your spare time.

Motion capturing relies on recording real human movement to animate characters in films and games.

TCG 17

THE ENTERTAINMENT GAME

CRAFTING THE FILMS & VIDEOGAMES OF TOMORROW

Bennett Ring dives into the future of entertainment to see where both the big and small screens are headed, and speaks with some of the key players in Australia.

Games and films mightn't seem like the closest of companions, yet both are closely related in the entertainment family tree.

Whether it's a game or a movie, both usually exist to tell a narrative, and games in particular have benefited from the experience of cinema when it comes to storytelling. It's not a one way relationship though; film might not have changed much over the last half century, but many of its largest advances were only made possible thanks to the tech behind games, 3D graphics. Let's take a look at the future of two of the world's most popular ways to while away our recreational hours, and how the two might become one in the foreseeable future.

SILVER SCREEN SEGUE

Compare Hitchcock's classics with the recent horror masterpieces made by Aussie Director James Wan (*SAW*, *Insidious* and *The Conjuring*), and the core storytelling tricks remain the same. Whether it's a cat leaping out of a

cupboard or a creature on the edge of the camera's view, the same scary tactics have been employed for decades. Today's films favour a more realistic style of dialogue and acting, but the biggest differences between then and now are arguably technological.

Computer generated images (CGI) have given movie-makers the power to deliver any scene imaginable, though they're still not quite perfect. Even the folks at WETA, the masters of CGI behind the *Lord of the Rings* trilogy, have strayed too far into the fantastic at times, with several scenes in the first *The Hobbit* film looking particularly hokey. Part of the problem was the use of new 48fps technology, where both the cameras and projectors used to display the film displayed the action with twice as many frames as today's 24fps standard. While 48fps, also known as high frame-rate (HFR) filming, does deliver much smoother looking images, especially when they're in motion, the added detail points out flaws in merging 3D computerised

images composited onto real scenery. It's a problem that is likely to become even more prevalent with 4K, which increases the resolution of home displays from today's 1,920 x 1,080 resolution up to 3,840 x 2,160.

However, as the images become clearer and smoother, we can expect CGI to continue to improve until we hit the magical endpoint of Photorealism. This phenomenon occurs when it's impossible to tell the difference between what's real, and what's not. It's going to require oodles of computing horsepower, but with today's rapidly evolving graphics processors many expect pre-rendered photorealism to be within grasp in the next few years. We can expect audio playback to improve too; already Dolby's new Atmos system is installing extra speakers in the ceilings of cinemas, creating all-encompassing audio globes.

OPEN TO ALL

According to Jason Wingrove, Aussie Director and Cinematographer, we're

"These days middle-aged mums are as likely to be playing *Candy Crush* as their teenage sons are *Call of Duty*."



Both film and game making relies heavily on 3D skills, which is broken into several sub-categories, such as animation, modelling, lighting and rigging.

4K is taking over the filmmaking industry, and RED cameras are some of the most popular ultra high-def recording devices around.



The latest technology from Dolby, referred to as Atmos, relies on ceiling-mounted speakers to create true surround sound.

also likely to see film head in the opposite direction to the \$100 million CGI-fests. The advent of miniature HD cameras and affordable high-quality audio equipment has opened up filmmaking. He explains, "I think we will see a rise in small or no-crew projects. Being a polymorph, able to turn your hand to every stage of a project, will become more valuable regardless of your chosen field." It makes financial sense to create films like this, and controlling the entire process will also empower filmmakers. "People who can shoot, direct and edit their own work, and create something from start to finish, will become a real commodity. This makes you more affordable, but it can also make you more flexible and creative."

These one-person film-making crews will also be able to utilise new technologies to capture amazing images. Inexpensive drones can be used to capture aerial shots which used to require helicopters equipped with specialised camera gimbals, while waterproof GoPros strapped to the back of a diver deep in the ocean will make for captivating footage. Regardless of whether it's a multi-million dollar epic or a film created for the price of a second hand car, technology is going to be a driving force in improving the film experience. And we haven't even touched on virtual reality yet...

CHANGING THE GAME

Before we do so, let's take a look at the other art form that so often aspires to

be regarded as narratively-worthy as film – games. The gaming industry already makes more money than the film industry, but it's not simply because the price of games and the associated hardware is so much more expensive. Gaming has seen explosive growth in the mobile and free-to-play arenas, where the cost to play is minimal.

While the PlayStation 4 and Xbox One prove there is still money to be made in the triple A gaming market, mobile and free-to-play have been the biggest growth areas over the last few years. Free smartphone games are a gaming segment that breaks the predefined stereotypes of what it means to be a gamer – these days middle-aged mums are as likely to be playing *Candy Crush* as their teenage sons are *Call of Duty*.

Facebook recently acquired the Oculus company for US\$2 billion, and it's all because of this device — the Rift prototype VR headset.



The Sixense Stem system promises to deliver an accurate way to input player movement into VR worlds.

"Why sit on a chair looking at Westeros through a large 2D window when you can become a character inside the world?"

Regardless of the platform in use, be it console, PC or mobile, we can expect hardware developers to continue to improve the technology in use, pushing towards the same holy grail of CGI film — photorealism. However, unlike films, where their visuals can be slowly pre-rendered in huge farms of networked computers, taking days to output a 30 second clip, today's game machines have to do everything in real-time, on the fly, as the player controls the game. This is why photorealism will take much longer to land in gaming, with most expecting it to take at least another decade.

BEYOND GRAPHICS

According to Tony Lawrence, Studio General Manager at 2K Australia, arguably the largest games developer in Australia, the focus shouldn't just be on making games prettier. Lawrence told us that "...there is now the opportunity to make games 'prettier'... but what I'd like to see are new game mechanics that weren't possible on previous generations, and we're only just scratching the surface of that now. For example, procedurally generated worlds and gameplay may create an infinite universe for players to immerse themselves in, with each gameplay experience being unique to the player every time". The surprise hit of 2014's Electronic Entertainment Expo was one such procedurally generated game, *No Man's Sky*, which contains a massive universe that built itself, after being given a set of general rules to follow.

VIRTUAL REALITY FOR REALS

Whether it was developers or directors

that we spoke to, all pointed to virtual reality (VR) being the next big thing in games and films. With Facebook recently spending two billion dollars to acquire Oculus, the company behind the VR prototype called Rift, there's serious money being pumped into virtual reality. Sony is also developing its own VR headset, codenamed Morpheus. We've tried these early prototypes, and it seems the tech is finally ready to deliver on the VR promises of the 1990s, when films such as *The Lawnmower Man* set imaginations alight.

While gaming seems an obvious fit for VR, film may not. However, Sebastian Marino (former Academy Award winner for one of his CGI techniques) recently formed a company specifically to make films for viewing in VR headsets. It's called 8i films, and Sebastian is cautiously optimistic about

the hurdles that lie ahead. "The realisation of practical VR for everyone has taken decades — a lot longer than everyone probably thought. There is certainly a lot of work to do yet but the fact that everyone is still incredibly excited about VR after all this time, speaks to people's ultimate appetite for this sort of content. I am confident that any hurdles will be overcome in time."

There are already 3D videos viewable online (tinyurl.com/m4kwgf7 is one), where the viewer can look in any direction while viewing a film, using their mouse to drag the view around. VR films will simply replace the mouse with the viewer's head movement, so wherever they look they will see part of the virtual world. Why sit on a chair looking at the land of Westeros through a large 2D window when you can become a character inside the world, looking around and interacting with whoever you please? Merge the storytelling of cinema with the interactive nature of video games, and then deliver it all via photorealistic virtual reality, and you've got yourself the future of entertainment.

VR headsets are just one part of the VR equation; capturing the players' movements on omnidirectional treadmills like this is the other.





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How to break into the industry

Master the basics of your chosen industry, and then build on that foundation with advanced skills and experience.

Before we explain the different approaches to entering these industries, we should warn you, whether it's film or game-making, both involve long hours on the job. These jobs often require weeks of overtime, spaced out by periods where there is no work at all, as they tend to be based on short-term contract work. Also, if game making is your primary desire, prepare to travel, as Australia's game development industry is tiny when compared to other countries.

You'll also need to decide what kind of role you want — there are dozens if not hundreds of different roles in both films and games. Camera operator, audio recorder, scriptwriter, director, producer, animator, actor, stuntman, set designer, costume designer, programmer, quality tester — the list goes on, and on, and on.

Once you've decided on the role you'd like to learn, you should pursue two courses of action. The first is to find a course or resource that will help you learn the skills required for the role. There are several filmmaking and game-making courses in Australia, and they're of highly variable relevance and quality, not to mention price. If possible, find out what percentage of an institute's graduates ended with a job in their desired industry, and try to get second-hand verification for this figure. According to Tony Lawrence at 2K games, "Formal education in game development or related fields are a great introduction to game development. Besides learning the basic skills required to develop games, they also introduce would-be game developers to the nature of game development — its hard work requiring considerable aptitude and attention over long periods of time."

Jason Wingrove agreed, though cautioned that, "...there will always be a gap between what you learn in a college or film school and the real world." School is simply the starting point — by far the best way to get a real career in film or games is to start making films and games, even before you've started any formal training. The gaming industry in particular puts a huge emphasis on a candidate's portfolio of existing work — without a game mod or character models to show, you won't be landing the gig. According to Sebastian Marino, this applies to the film world as well. "If you want to make films you have to make films and then find ways to connect them to your audiences. It's a very interesting time with the advent of the DSLR, YouTube and other channels that allow people, even large productions, to distribute their own films."

Given the popularity of these kinds of roles, and their scarcity in Australia, we suggest potential candidates think seriously about how passionate they are towards their chosen field. It will take many years of hard work to attain the skills necessary in these highly competitive industries, but the risks can be worth it — if you love the job you do, you'll never work a day in your life. ■



Oculus isn't the only company interested in VR — Sony recently unveiled its own VR solution, but it will be tied to the Playstation 4.



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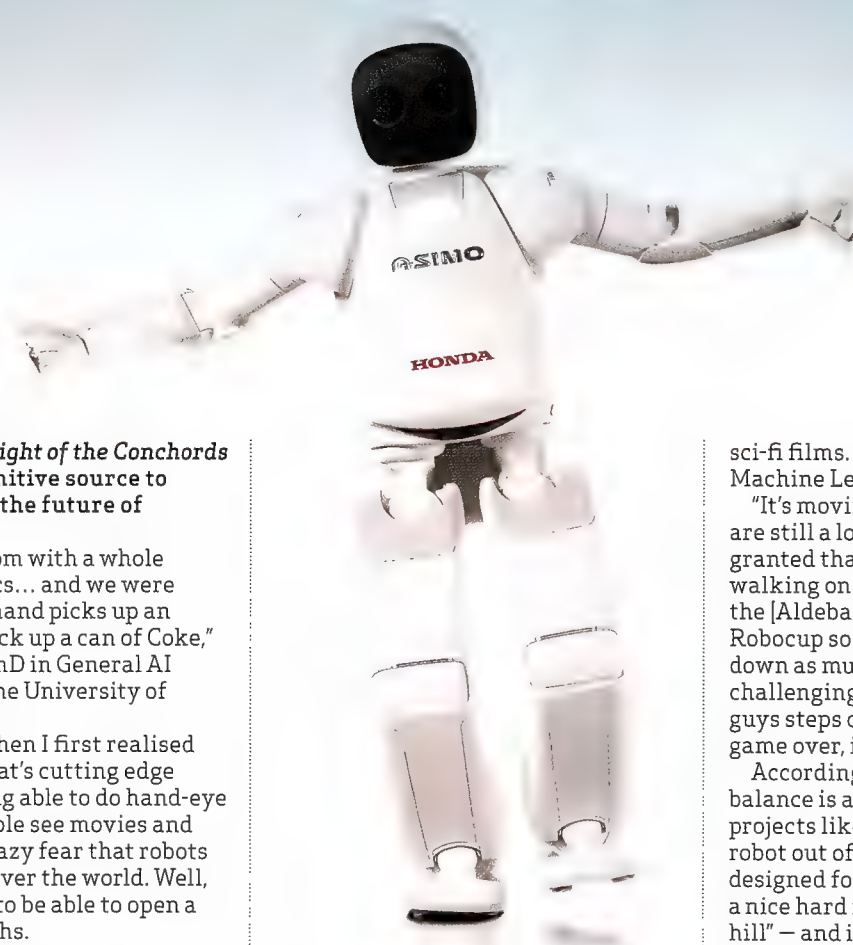
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BEYOND SCI-FI

THE FUTURE OF AI & ROBOTICS

The distant future. The year 2000. Finally robotic beings rule the world. The humans are dead! Well, not quite. *Craig Shover* explores what robotics and AI really have in store for us.



It turns out *Flight of the Conchords* isn't the definitive source to speculate on the future of robotics.

"I was in this room with a whole bunch of academics... and we were discussing how a hand picks up an object. Like just pick up a can of Coke," says Marc Chee, PhD in General AI Game Playing at the University of NSW (UNSW).

"And that was when I first realised where we're at. That's cutting edge research, just being able to do hand-eye coordination. People see movies and they've got this crazy fear that robots are going to take over the world. Well, [they] might have to be able to open a door first," he laughs.

While an exaggeration, the point is taken: we're nowhere near the doomsday scenario shown in so many

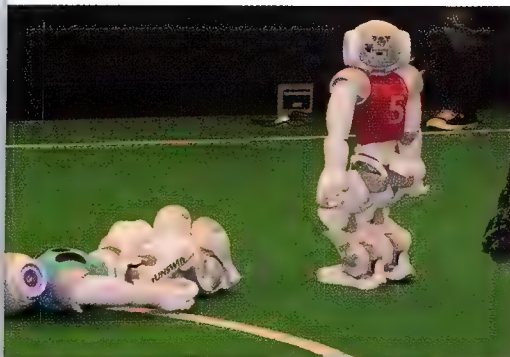
sci-fi films. Sean Harris, PhD in Machine Learning at UNSW, agrees.

"It's moving pretty quickly, but there are still a lot of things that we take for granted that are really hard. Like walking on two legs. As you've seen by the [Aldebaran Nao robots used in Robocup soccer competitions] falling down as much as they do. It's really challenging. As soon as one of those guys steps on another one's toes, it's game over, it's on the floor."

According to Harris, robustness and balance is an issue even for high profile projects like Honda's Asimo. Take a robot out of the safe environment it's designed for – in this case away "from a nice hard floor and put it on a grassy hill" – and it flounders.

But little by little, the barriers in front of our robot future are being chipped away.

Asimo is cute and intelligent, but its physical robustness is limited.



The Nao are somewhat capable of righting themselves after falling over. But more than once in the game that APC witnessed, human help was required to get things running again.



ATLAS is designed to assist in rescue operations and emergency services. Right now it's still tethered by power and data cables that run from the ceiling. Boston Dynamics hopes those will be severed by the end of the year.

HERE I AM, BRAIN THE SIZE OF A PLANET...

Important developments are happening on the frontiers of accessibility to robots, human friendliness and lowering the cost of entry to the field.

"I have to say this is easily the most exciting time to be involved in the industry, it's going to change the world," says Greg Sale, CEO and MD of KUKA Robotics Australia.

"The industrial robot is poised for, in my opinion, the biggest evolutionary step since 1973... the dawn of the industrial robot which can work alongside humans, called HRC or Human Robot Collaboration".

Sale is referring to KUKA's impressively sensitive LBR iiwa, a seven-axis robotic arm with torque sensors built into each axis. Its controller is Java-based, allowing for user customisation. While not the first to do so, it also supports learning by demonstration. This allows a human to physically guide the arm through a range of motions to teach it, the robot later refining the actions to adjust to any given situation.



KUKA's iiwa is amazingly adept.

"That's cutting edge research, just being able to do hand-eye coordination."

"This is a robot which can not only work alongside humans safely, it's a robot you can start and stop with the touch of your hand," Sale says.

Learning by demonstration in particular brings new opportunities, as it "opens automation up to non-automation people, and their new ideas."

The democratisation of robotics is something 2Mar Robotics and Robogals founder Marita Cheng is also passionate about, highlighting the maker movement as a major enabler. The popularity of iOS and Android, combined with cheap developer boards like Arduino and affordable 3D printers has helped contribute towards "robots that can help us in our day to day lives."

There are people working on reducing the costliness of components, too. Cheng cites Melbourne startup Modbot, which is developing cheaper, all-in-one actuators. By making the parts available at a "consumer/hobbyist/education price", they should help "teach the next generation of roboticists", while lowering the barrier to entry.

TRANSFORM AND ROLL OUT

If Google has anything to do with it, our cars will soon be robots too.

"They've just done a new one," enthuses Harris. "It has no steering wheel or pedals, it's like a little smart car [with] a passenger seat on both sides. There's no input, just a little tablet in the middle. It says 'where do you want to go'... and you say 'take me

to Jane's house on Liverpool Street' and it just drives around the corner and lets you out at that house."

While people initially freak out at the lack of direct control and worry about what will happen in an accident, Harris says that "it earns their trust over time".

There's also the stats. As of April 29 this year, Google cars had done 700,000 miles of travel. Only two accidents had occurred in that time, and both were caused by humans. "The robot never made a mistake," Chee says. "There's a minimum skill level the robot has to have before it's allowed on the road. Whereas we've got tests, but..."

Harris interjects. "Robots don't drink, they don't text, they're not fiddling with the radio, robots just drive, right? They're not distracted, they're not tired, they concentrate on driving."

"Would you prefer to be stuck in a traffic jam," Chee asks, "or sit there and read a book and just be told when you're at your destination?"

COME WITH ME IF YOU WANT TO LIVE

Google also demands attention on the military side with its acquisition of Boston Dynamics. The company's DARPA-funded "BigDog", "LS3", "Wildcat", "PETMAN" and "ATLAS" projects are scarily robust and capable. We recommend you head to YouTube for these — the videos demonstrate their capabilities far better than our words ever could.

In this year's *Future Land Warfare Report*, the Australian Army recognised significant opportunities for robotics to reduce manpower, enhance accuracy and increase speed of operations. It identifies roles for route clearance, bomb disposal and reconnaissance missions, along with rapid equipment deployment in the field through 3D printing. But it concedes "it will also raise doctrinal and ethical questions for militaries around the globe."

So far, militaries have limited the autonomy of their mechanical units. Some are 100% remote controlled, while others, like unmanned aerial vehicles (UAVs, commonly called drones), can fly autonomously once given instructions. But all units still require a human to make that final kill decision.

In June 2013, the UN called for a moratorium on Lethal Autonomous Robots (LARs), citing "far-reaching concerns about the protection of life during war and peace", compliance of programming with "international humanitarian law" and warning that "no adequate system of legal accountability can be devised" for robots that can make their own decision to kill.

I AM FULLY FUNCTIONAL

Social acceptance is a large hurdle for robotics. Take the uncanny valley — a term used to describe something that approaches human, but is just off enough to make a real human unnerved. While we are making progress in overcoming the creepy factor, sometimes we're better off making things not look humanoid at all in the first place.

"If it looks like an appliance, people will treat it as such," Chee says. "Like the Roomba, people just let that thing go around anywhere. But I think if the Roomba looked like a person, it'd be much weirder if that thing just rolls into your bedroom."

Speaking of the bedroom — sex robots bring multiple social concerns, from body image, to relationship issues, to the legal system. South Korea has been debating whether establishments that offer access to sex robots should be considered illegal under prostitution laws.

Acceptance is easier where there's need. Cheng, whose JEVA robotic arm aims to help those with disabilities, finds that people in the disability space are "very positive about technology" and "really receptive of Robotics."

"A lot of people I've spoken to say they see it as the next step before being given the ability to control their own arms and legs again using more... invasive techniques... some

Robotics are gaining traction in military applications.



"We may see [robotics] as indispensable, in much the same way we see electricity as indispensable."

people say to me 'I believe in my life time that I'll be able to walk again' or 'I'll be able to use my arms again', so it's really great to see that optimism... they see it as a huge boon."

But what about jobs? As robots creep across almost every possible field, from manufacturing to military, home automation to health and aging, to space and deep sea exploration, there's concern that jobs will disappear, drastically reshaping economies and lifestyles. Bill Gates recently referred to it as "software substitution", and believes that "20 years from now, labour demand for lots of skill sets will be substantially lower".

In some cases, robots can already do jobs humans are doing now, but are held back for reasons other than ability. "Quite often we will see people still being used in a final QA even in heavily automated plants, sometimes for legal or contractual requirements," Sale says. "We often see the law lagging the technology."

We'll soon reach a point where your skill at doing something will be less important than your skill at interacting with a robot that does that same task, just more efficiently.

Cheng sees the positive side, and the opportunity. She thinks that at the pace at which technologies get released, we'll have plenty of time to get used to them, to understand the role they play in our lives. "By that time, we may see [robotics] as indispensable, in much the same way we see electricity as indispensable."

"I think humans have adapted. In the past [we've] said with technology

The shroud of Turing

The Turing test, an idea that a computer can convince humans that it is a human, is losing relevance according to Chee.

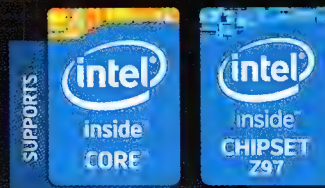
"I think we're behind [Alan] Turing's schedule... he expected by 2000 that we would easily get around [the test]. But at the moment... I would say we're nowhere near it."

He dismisses the recent media sensation around a chat bot that supposedly "passed" the Turing test as "media spin". "[It] pretended it was what, a 13 year old Ukrainian boy? So, English as a second language, just post-adolescent, lacking in vocabulary."

"The Turing test has become 'how do we use psychological tricks to pass this specific test'. It's stopped being a challenge for this sort of grand intelligence, able to reason and think about anything around it. So it was an awesome idea, but it's gotten to the point where people are focusing only on the test, and we've missed the point."

we'll have more time for our families, more time for recreation. Now we have the internet, we have personal computers, and we're more connected than ever and we're working harder than ever. So, I think humans will adapt to find useful things to do."

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BUILDING ROBOTS & CODING AI:

How you can get involved

"For a hobby, Lego Mindstorms is great," says Chee. "You get to build a physical robot with wheels, sensors, actuators, and on top of that you get a programmable unit that allows you to actually work on a simple AI and behaviours."

Cheng recommends hobbyists and neophytes "should definitely get

involved in Robogals, [through] the web site. Contact the local Robogals chapters to see if they can run a workshop for their school. Otherwise there's a lot of MOOCs (Massive Online Open Courses) out there for free... that teach programming."

Many cities have hackerspaces, providing access to things like 3D printers, where like-minded creators

can build. Cheng says that "getting involved in a group of some sort where other people are building robots where you can go and watch and lend a hand, just pick things up as you go is a good way to learn."

"To seriously get into it, you probably want to study computing," says Chee. "Most computer science/engineering/software degrees will put you in a position where you can take AI courses. There's mechanical engineering too (and mechatronics, a sub-field) that looks a lot at the physical side of robotics."

Sale agrees on the engineering degree, but sees the field expanding. "If they wanted to become an integrator, robot programmer, service engineer this is the way to go. We are however seeing a lot of robots globally being used by people who are in design, or architecture, with limited robot experience using custom design software to make the robots easier to use."

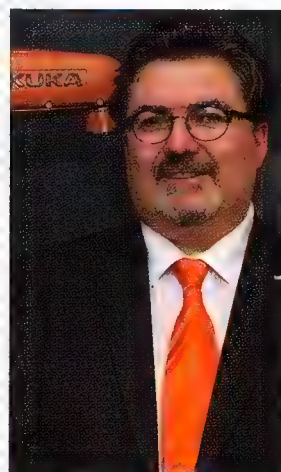
"Can I also add that if people become involved in robots, it's an incredibly transportable industry, allowing people to work around the world in their field. Even if they have their eyes set on developing the next big thing, why not set your sights on working for the factory in R&D in Europe or Asia? It's all possible." ■



Marc Chee (L) and Sean Harris (R), PhD students at UNSW.



Marita Cheng, Young Australian of the Year 2012, Founder of 2Mar Robotics and Robogals. Image courtesy of University of Melbourne.



Greg Sale, CEO and Managing Director of KUKA Robotics Australia.

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USB	✓	✓	✓	✓
Wireless LAN		2.4 GHz	2.4 GHz & 5 GHz	2.4 GHz & 5 GHz
VoIP				✓

super » forging future tech

Oshkosh's TerraMax predates Google in the driverless vehicle market.



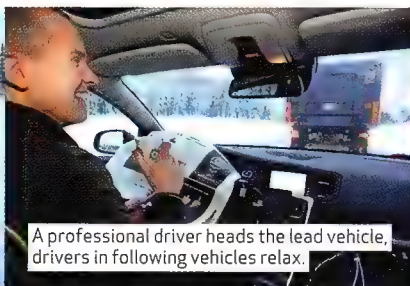
TECH FRONTIERS

WEARABLES • AUTOMOTIVE • 3D PRINTING

They represent some of the hottest emerging technologies on the planet, but where are they headed — and how can you get on board? Darren Yates reveals all.



Volvo and the SARTRE group are creating a multi-vehicle road-train system.



A professional driver heads the lead vehicle, drivers in following vehicles relax.



Google has built its own car — with no steering wheel or pedals.

If our look at future tech was akin to an expensive investment seminar, 'gaming and movies' would rate the 'high-risk/high-return' investment tag — back the right horse and you could win a motza, but you could also lose the shirt off your back. By contrast, 'robotics and artificial intelligence' would be the slow-burn cash-in-the-bank safe bet.

But when it comes to the (seemingly) diverse frontier engineering areas of automotive, wearable computing and 3D printing, I reckon these are the real 'speculator' investments where almost anything is possible.

AUTOMOTIVE? FRONTIER TECH?

Sure, looking at the local market, the Australian automotive industry is looking very much like a dead man walking, with Toyota recently joining Holden and Ford in announcing the

closure of local manufacturing by the end of 2017. The irony is these closures come just at a time when the rest of the world is investing in new areas of automotive research and design.

In the US and European Union, regulatory tightening of emission levels continues to force carmakers to develop new and smarter drivetrain and body packages that reduce fuel consumption and emissions (tinyurl.com/n7xmcbbh). Technology is also playing a leading role in delivering new safety features from automatic reverse parallel parking to vehicle emergency braking. But in future, tech will literally be jumping right into the driver's seat.

THE DRIVERLESS CAR

We've all seen free-roaming robots; we've even shown you how to build and hack a few over the last year or so in our monthly Arduino Masterclass.

But the race is on to scale up the concept to power the next-generation of full-sized vehicles.

Google's driverless car has had plenty of press of late, with the company reported to have now clocked up over 1.1 million kilometres of testing. Beginning with a retro-fit to a standard Toyota Prius in 2012 (tinyurl.com/dxqj9xr), Google has taken its research considerably further, announcing in May 2014 the building of its own self-driving vehicle with no steering wheel, accelerator or brake pedals. (tinyurl.com/meb775g).

Google's research is led by engineer and former head of the Stanford University Artificial Intelligence Lab, Sebastian Thrun, who, with his Stanford team, won the 2005 DARPA Grand Challenge driverless car competition run by the US Department of Defence. Also in that race was the Oshkosh TerraMax tactical cargo

"There is growing concern over the driverless concept with regards to security and possible nefarious applications."



It'll be a while, yet but 3D printed homes like this one in China are on the way.

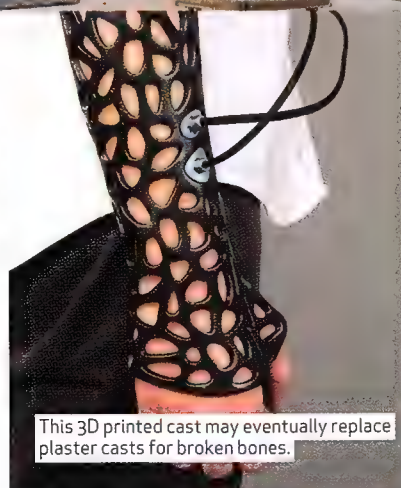
truck. First seen in 2004, the technology behind the TerraMax's self-drive capabilities was the forerunner to that used by Google, namely the high-speed rotating LIDAR (light radar) module on top of the vehicle roof (tinyurl.com/mw6deg3).

Combined with GPS and on-board cameras, LiDAR creates a real-time 3D model of the surrounding terrain, allowing on-board computers to identifying obstacles and adjusting the vehicle's navigation on the fly.

European carmaker Volvo is also involved in driverless car research, working on a collaborative driverless roadtrain project called SARTRE (Safe Road Trains for the Environment, www.sartre-project.eu). It's a cross between trains and cars, with a professional driver up front in the lead vehicle and following cars in the group or 'platoon' running in a drone-like mode, allowing their drivers to make phone calls, read a book or virtually 'nod off'.

HACKING CONCERNS

But there is growing concern over the driverless concept with regards to security and possible nefarious applications. If computers can be targets of cyber-attacks, should we expect cloud-connected driverless cars to be any different? This is the question a US Senate hearing began asking last year, approving the gathering of research to determine what threats exist and how they could affect driverless vehicles.



This 3D printed cast may eventually replace plaster casts for broken bones.

More recently in July 2014, an internal report from the US's Federal Bureau of Investigation (www.bbc.com/news/technology-28344219) was reported to suggest driverless cars could become 'lethal weapons', allowing criminals to 'multitask' in ways today's cars make impossible. Think 'Streets of San Francisco' TV shows with car chases and bad guys hanging out of car windows firing weapons, except now, they'll have both hands free. By the same token, law enforcement officers would have the same ability to multi-fire in pursuit. The results could get messy.

With suggestions driverless cars could be available within five years, like everywhere else, there's considerable pressure on laws and lawmakers to keep up with the technological advances.

3D printing

Similarly, while 3D printing has captured plenty of interest, it hasn't turned that interest into a booming consumer market. Right now, most consumer-grade 3D printers begin life as a Kickstarter campaign or from larger specialist manufacturers such as Stratasys (the new owners of Makerbot). And of the mainstream 2D printer makers, only Hewlett-Packard has come close to saying it has product somewhere on the horizon. But to look at it from a consumer perspective means missing the bigger picture — 3D printing is making inroads into industries as diverse as building homes to building human organs.

HEARTS, KIDNEYS AND LIVES

Researchers at Stanford University are using 3D printing to make full-scale replicas of patient's hearts for use in surgical preparation, saving surgery time and giving doctors the ability to pre-test procedures before having to trial them on live patients (tinyurl.com/q7kabh5).

Another promising concept is the Osteoid 3D printed medical cast developed by Deniz Karasahin. If you've ever broken a limb, you'll remember the thick plaster cast as an ever-present and annoying reminder of your mistake. The Osteoid cast aims to change cast moulding forever by delivering a uniquely personal cast 3D-printed from standard ABS plastic that helps speed up bone healing, while at the same time offering much greater skin aeration than plaster casts. The design also allows the ability to add ultrasonic pulses to stimulate bone repair. The added potential of this design is that for upper-body limb breaks and fractures, the cast is small enough, it could be printed on large desktop 3D printers selling for under \$10,000 (tinyurl.com/mqg9prd).

3D PRINTED HOMES

Scaling it up on an industrial level, 3D printing has even shown potential to be used to construct low-cost homes in China. Made from recycled building materials, ten homes were printed in 24 hours for just \$4,800 each by Winsun Decoration Design Engineering earlier this year. The printer cost the company around US\$3 million to build but, obvious building code regulation discussions aside, ideas like this may one day help address housing shortages around the world. (tinyurl.com/puefqmo).

DRIVERLESS

And finally, while it might seem these technology areas are quite disparate, there's a potential for some synergy in a new 3D printed Titanium bike created by UK manufacturer Renishaw for Empire Cycles. Taking an Empire Cycles design, Renishaw 3D printed a new frame that's 33% lighter than the original, with the barely-there seat post bracket tested to six times beyond German DIN EN 14766 safety stress standards (tinyurl.com/q9ex227).

These are the technologies of the future — but they're increasingly finding their way into products today.

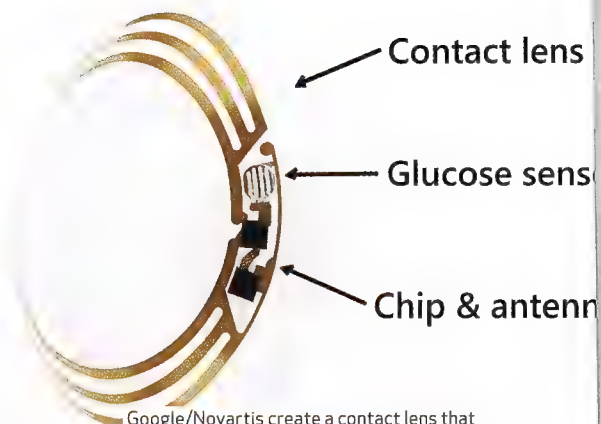
LG's G Watch utilises Google Wear, but battery life is reportedly a concern.



"But having the technology alone is no guarantee for success."



Google Glass is powered by a dual-core ARM Cortex A9 processor.



Google/Novartis create a contact lens that measures glucose levels of tears.

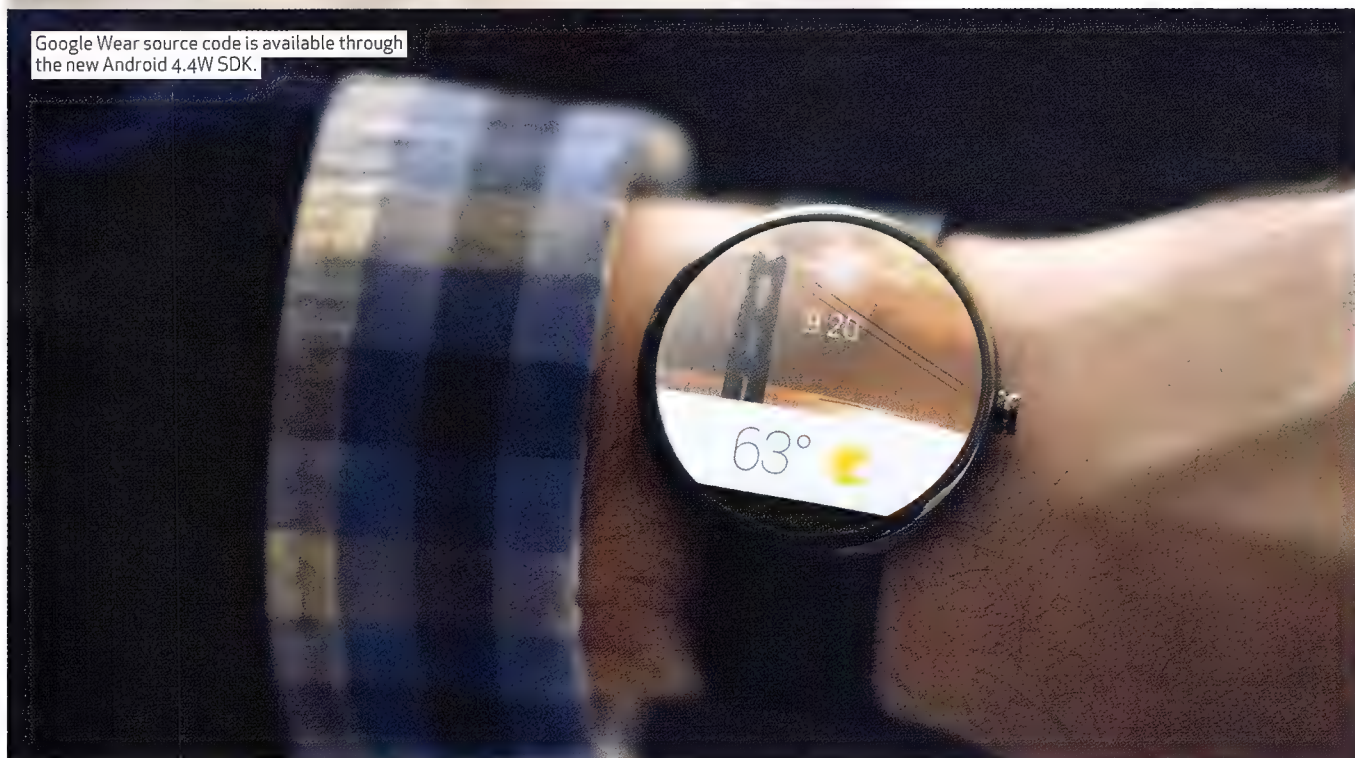
WORKING ON WEARABLES

Wearable computing technology has accelerated out of the blocks in the last couple of years on the back of falling prices for low-power CPUs. Chip designer to the stars, ARM Holdings, continues to pump out Cortex A- and M-series CPU core designs and their affordability and extremely low power consumption is making possible the companion-class devices we now see. For example, Google Glass is powered by Texas Instruments' OMAP4430 dual-core CPU built around two ARM Cortex A9 cores.

But having the technology alone is no guarantee for success. Earlier this year, sporting goods giant Nike announced it was killing off its FuelBand division, with rumours it will tag onto Apple for its long-rumoured iWatch computing device.

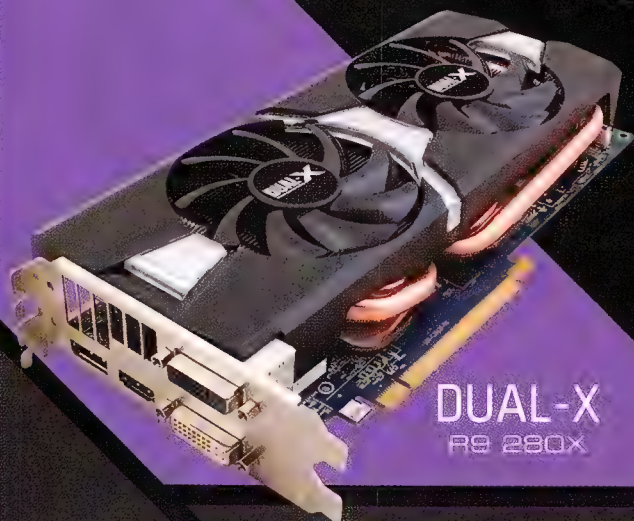
So far, it'd be fair to say that wearables haven't set the world alight

Google Wear source code is available through the new Android 4.4W SDK.



So Cool, They're hot

The SAPPHIRE Dual-X R9 series

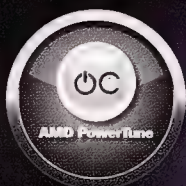


DUAL-X
R9 280X



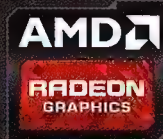
DUAL-X
R9 280

ULTRA HD
4K RESOLUTION



The 'dual' in Dual-X refers to the two highly advanced cooling fans that are coupled with multi-heatpipe technology to cool mid- to high-end graphics cards. The fans are amazing: each blade boasts a sleek airfoil shape that increases cool air throughput so they can run slower. Even when you're pushing processing power to the limits. Even when you're overclocking.

The quiet-running fans work with multi-heatpipes and heatsinks that take away heat from the processor to the fans. Plus, dust-repelling bearings radically reduce failure caused by the build-up of dirt. In short, it's a quiet, efficient way of cooling your graphics card - even when you're pushing it to the limits.



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with their design, functionality or battery life, tending to fall into the same black hole as 3D printing — nice idea but do I really need to own one? But as it did for smartphones, Apple is expected to rewrite the market rulebook on what future wearables will need to succeed with the forthcoming launch of the iWatch. And not everyone is happy about it.

In late-June, US device maker Misfit announced it would be making its Shine device software compatible with its direct competitor, the Pebble smartwatch. Misfit CEO, Sonny Vu, told the *Wall Street Journal* he believed the up-coming iWatch and Google Wear-powered devices could sound the death knell for the fitness band market, using it to state 'why should we cling onto a dying business?' (tinyurl.com/pghtehk).

CONSUMER HEALTH TECH

Google has made plenty of PR points with its Google Glass, but it'll very likely be another sight device that has greater impact.

The search giant has teamed up with global healthcare company Novartis to develop smart contact lenses. The first is a contact lens that automatically measures glucose levels of tears and transmits the results to an external device such as your smartphone. The second has the potential to revolutionise the corrective eyewear industry — a contact lens that will auto-focus to suit your vision, removing the need for multi-focal glasses.

But that's just the start — according to American Optometric Association head, Thomas Quinn, tears contain markers for a range of cancers including breast, lung, prostate and ovarian cancers that can be similarly detected (tinyurl.com/pmbtrbd). Add in the possibility of targeted and timed medicine delivery and smart contact lenses could revolutionise many aspects of daily healthcare.

ANDROID WEAR

And to further boost interest and innovation in wearables, Google has released a new Android 4.4W software development kit (SDK) specifically to take advantage of its new Android Wear platform. The new kit enables developers to deliver notifications, apps (including voice-activated), as well as sending and syncing data between devices (developer.android.com/wear).

So while consumer fitness bands might be ruling the wearables market right now, expect these devices to be overrun by healthcare-related products in the not-too-distance future.



The first 3D printed Titanium bike loses weight, but not strength.

Score a job in the emerging tech scenes

With the rise of 3D printing, automotive design, and wearable technology, there's a growing maker community in Australia — essentially, people who build technology-based stuff as a hobby. Check out hackerspaces.org/wiki/Australia for details of local maker communities in your area. Or just start your own!

Automotive

While local manufacturing jobs will go, Holden is expected to keep its Melbourne automotive design team together, totalling up to 150 workers. There'll be around 70 engineering jobs for tuning inbound vehicles for Australian conditions.

Ford is expected to keep its Broadmeadows facility to become one of the company's four global R&D centres with an expected 1,100-strong workforce designing vehicles for around the world. Recruiting began for a new design engineer graduate program earlier this year (tinyurl.com/k7ykjep).

But Toyota Technical Centre Australia, Toyota's local engineering arm, won't be so lucky, with reports the company believes the local R&D arm 'is not viable in the long term without local production' (tinyurl.com/mv4e2zf).

Beyond that, and despite up to 50,000 local parts manufacturing jobs at risk, it appears the bulk of future automotive jobs will head offshore.

Wearables

While some in the industry are waiting to see the fallout from the iWatch's arrival, there'll still be considerable need for wearable computing designers and engineers — in fact, the skills that built phones and tablets will also drive the wearable computing boom. It's all about software and electrical engineering — software engineering to write the code that creates the device features; and electrical engineering to design the hardware that does the work. Just how many of these jobs will be created here remains to be seen.

Almost all local Australian universities offer a software engineering undergraduate degree of some description. For electrical engineering, some of the more notable schools are University of New South Wales (UNSW), University of Melbourne, Monash University, University

of Technology Sydney (UTS), RMIT University and University of Wollongong.

These are great places for formal education but for something less 'high-powered', there's the growing maker community in Australia — essentially, people who build technology-based stuff as a hobby. Check out hackerspaces.org/wiki/Australia for details of local maker communities in your area. Or just start your own!

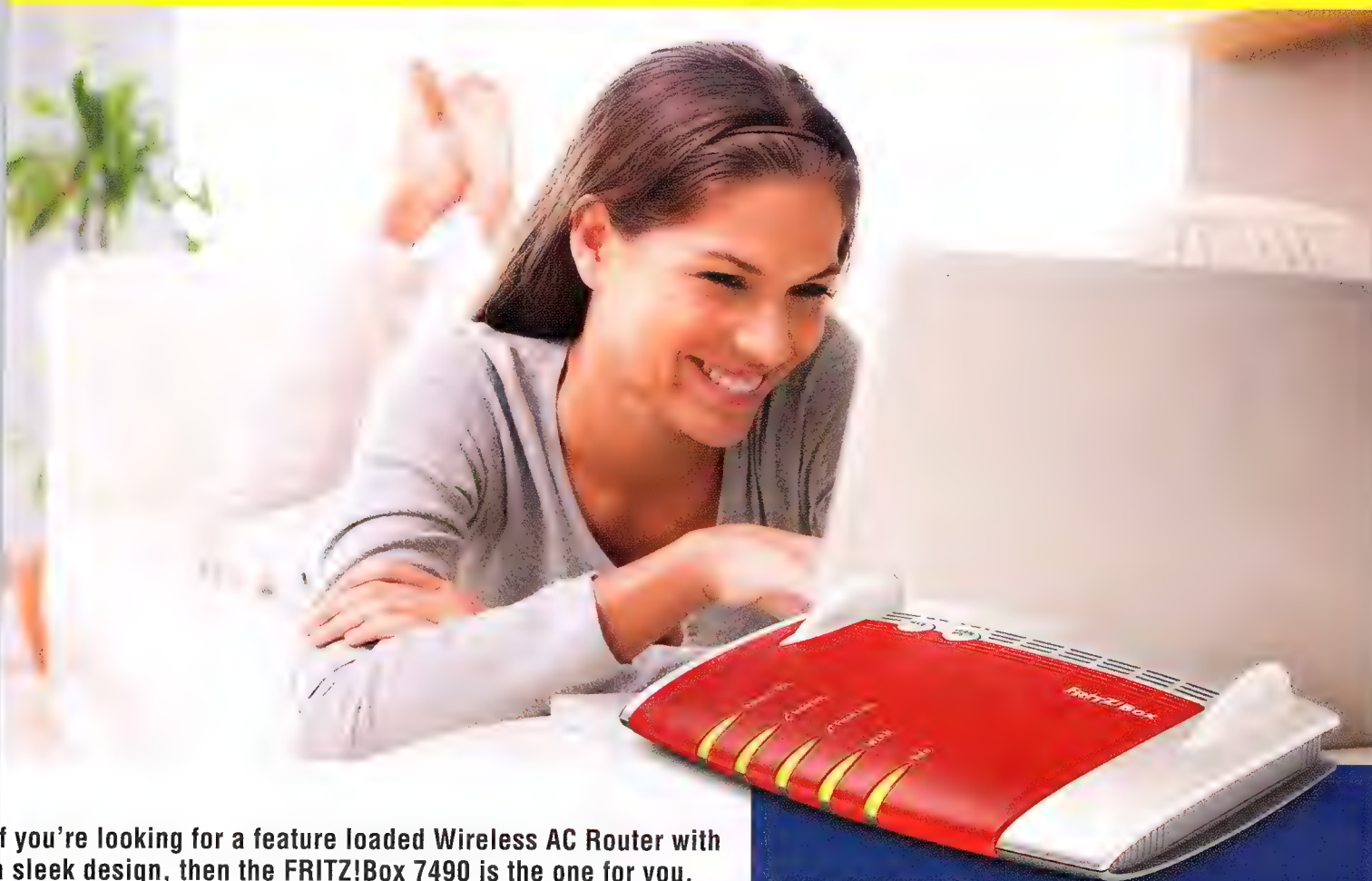
A word of warning: If maths isn't your thing, you'll need to make it your thing — engineering without mathematics doesn't bear thinking about.

3D printing

Since 3D printing is still fairly new from a consumer perspective, there are no local dedicated university degrees solely covering 3D printing we could find. That said, you'll find subjects that touch on it, such as the University of South Australia's Advanced IT Prototyping Concepts (COMP4034) subject within its Bachelor of IT degree. In fact, you're more likely to come into contact with a 3D printer as part of your existing studies, for example, Monash University and its medical degrees. We recommend talking to a student advisor or ask your preferred university before you sign up. Again, if it's more a hobby for you, try your local maker community and see if they have one on-site you can play with.

If you're more serious though, think about buying a 3D printer. Local retailers are asking \$1,200 or more for 'ready to fly' models, but for the adventurous, you can buy compact 3D printers online from the US for under \$600 (plus shipping). If you're ready to jump from 10,000-foot height without a parachute, try building a printer from a kit like I did — I can tell you from personal experience (and a little swearing), there is no faster way to learn about 3D printers than by building one yourself! ■

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Crossing the Devil's Canyon: Intel 9-series builder's guide

With a modest budget of \$200, Craig Simms grabs an Intel H97 and Z97 motherboard from each vendor, puts them through their paces, and recommends the best new Intel CPUs to go with 'em.

As sure as the earth spins around the sun, Intel has released another set of motherboard chipsets. This time it's H97 and Z97, two very similar products.

Z97 is positioned as the superior of the two, aimed at overclockers and power users. It has only two advantages over H97: it will handle up to 4-way SLI or CrossFire configurations depending on slot availability, and allows K-series processors to overclock by both ratio limit and base clock.

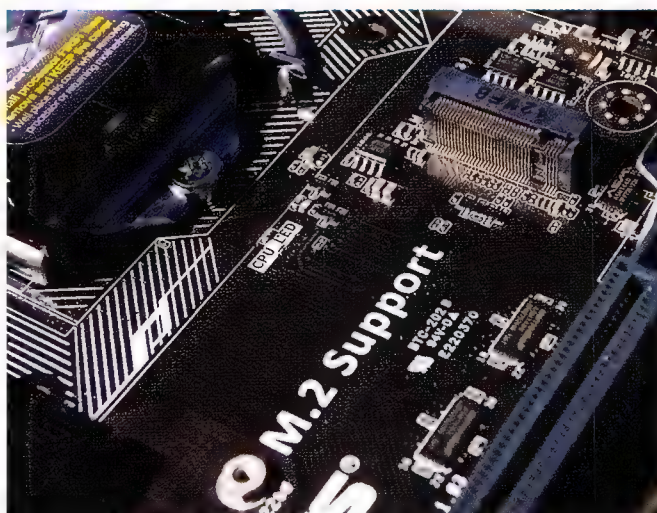
A few H97 boards are 2-way CrossFire certified; just take in mind that the second PCI-E slot will inevitably clock down to x4, which will impact your performance.

WHAT'S NEW PUSSYCAT?

While Intel favours changing up sockets regularly to pad profit margins, the Z97 and H97 chipsets still run off the previous generation's Socket 1150. This means the boards will happily run Haswell and Haswell-refresh CPUs (or Intel 4th Generation Core, to give them their official name). They'll also support the newer, yet-to-be-released Broadwell-based chips. Don't hold your breath for those though – current information has them delayed until Q2 2015.

In fact, little has changed at all since the previous generation, save for a minor software update to Intel's Management Engine firmware and support for the SATA 3.2 spec. The latter is being implemented in the form of M.2 and SATA Express connectors, each with their own strengths.

At only 22mm wide and from 30-110mm in length, M.2 is effectively a merger of the PCI-E Mini Card and mSATA interfaces. It allows access to the PCI-E 2.0, SATA 6Gbps and USB 3.0 buses, meaning it can be potentially used for storage devices, Wi-Fi,



The M.2 connector is tiny, and is raised off the motherboard. The card itself sits parallel with the board.



Two physical SATA connectors and a third plug makes up a single SATA Express connector.

Bluetooth, GPS, NFC and more.

SATA Express is slightly more limited in that it doesn't grant access to USB 3.0. The physical interface itself is comprised of two SATA connectors, along with a third plug for SATA Express only. Either one SATA Express cable plugs into the whole lot and accesses PCI Express, or two legacy SATA drives can be plugged and they'll go over the SATA 6Gbps bus.

Right now Intel has exposed two

lanes on the PCI-E 2.0 bus to SATA Express and M.2, allowing for up to a theoretical 1GB/s of transfers. When that bumps to PCI-E 3.0, you'll get double the speed – although take in mind that the practical results will be lower due to overheads. The ultimate goal is to transition to the attractively named SFF-8639 connector, opening up four lanes and doubling the bandwidth again for both PCI-E 2.0 and 3.0.

"The boards will happily run Haswell and Haswell-refresh CPUs. They'll also support the newer, yet-to-be-released Broadwell-based chips."

PLAYING THE SLOTS

Without fail, every single H97 motherboard on the market has one PCI-E 3.0 x16 slot, one PCI-E 2.0 x4 slot, and two PCI-E 2.0 x1 slots. Most of them, curiously, have three PCI slots, with only the ASUS H97 Plus and Gigabyte GA-H97-HD3 bucking the trend by reducing that to two. While there's no doubt the rare PCI card is still out there that can do a decent job, it's weird to see the legacy interface still so prevalent, considering it is now 22 years old and PCI-E has been around for a decade.

If you actually want to make use of the new storage interfaces available to you, make sure to check the motherboard first. Some offer some M.2, some M.2 and SATA Express, some forgo the future altogether in favour of the standard six port SATA complement.

WHICH CPU?

With Broadwell far off in the horizon, Intel has filled the gap by releasing its Haswell-refresh processors, codenamed Devil's Canyon. Offering small speed increases across the

board, Intel's also taken the opportunity to tweak its K series chips, modifying the thermal interface material and power delivery to provide better overclocking than the previous generation. So if you have to buy right now, which CPU is for you?

Power users will snap up a K-series CPU without question. Those looking for pure multi-threaded performance for tasks like 3D rendering and video encoding will get the most out of the king-of-the-hill Core i7-4790K, purely down to its Hyperthreading ability and high clock speed.

It also has a considerably higher initial clock than its non-K variants, and runs its max graphics frequency 200MHz higher — if you're actually going to run Intel graphics. As an overclocker's chip, business features like vPro are disabled.

Those who are more budget conscious or gaming focused may prefer to stick with the Core i5-4690K. While it dumps Hyperthreading, it is more than capable of handling the latest big budget titles.

If you're never going to overclock, you can save yourself a pretty penny by avoiding the K-series processors altogether. At this point, ask yourself if you will only ever use one graphics card — if the answer is yes, consider an H97 board over Z97, as the performance is identical.

For the non-K processors, it's all about bang for buck. At the moment, for pure megahertz per dollar performance the Core i5-4590 occupies the sweet spot. It does fall 200MHz short of the vanilla 4690, but at the time of writing that's a perk that would cost you an extra \$25.

While you can save a huge wad of cash by going Core i3, for flexibility we'd suggest giving these chips a miss. With only two physical cores, unless you have modest intentions they may not meet the grade.

BENCHMARKS

With identical chipsets, it's no surprise that all boards performed identically, within margin of error. Our test system was comprised of a Core i7-4790K, 16GB RAM, GeForce GTX 670 and a SanDisk Extreme 480GB SSD.

BENCHMARKS

	ASROCK FATALITY H97 PERFORMANCE	ASROCK Z97 EXTREME 4	ASUS H97- PRO GAMER	ASUS Z97-A	GIGABYTE H97 GAMING 3	GIGABYTE Z97X GAMING 3	MSI H97 GAMING 3	MSI Z97 U3 PLUS
PCMARK 8 - HOME (SCORE)	4,671	4,651	4,687	4,746	4,605	4,634	4,628	4,648
COMPANY OF HEROES 2 (1080P, MEDIUM DETAIL)								
- AVERAGE FPS	43.51	43.36	42.27	42.85	43.33	43.39	43.1	45.47
- LOW FPS	28.43	27.83	26.27	27.32	27.67	27.86	27.75	32
CINEBENCH R15								
- OPENGL RENDERING (AVERAGE FPS)	147.58	142.59	153.09	146.98	149.65	146.13	148.51	153.23
- CPU RENDERING (SCORE)	843	839	843	839	845	843	842	880
X264 HD BENCHMARK 5.01								
- 1ST PASS (AVERAGE FPS)	87.52	86.79	86.18	85.14	85.64	86.53	86.72	86.21
- 2ND PASS (AVERAGE FPS)	18.37	18.33	18.42	18.18	18.27	18.41	18.4	18.29
AS SSD								
- SEQUENTIAL READ SPEED (AVERAGE MB/S)	486.17	485.58	488.42	486.53	485.91	484.35	479.86	480.36
- SEQUENTIAL WRITE SPEED (AVERAGE MB/S)	223.8	244.7	255.93	243.08	236.31	246.48	227.44	240.32
- 4K RANDOM READ (AVERAGE MB/S)	21.08	20.91	20.75	23.66	21.86	22.32	20.4	18.72
- 4K RANDOM WRITE (AVERAGE MB/S)	16.12	16.54	15.23	16.97	16.18	16.15	15.95	15.31

boards



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ASRock Fatal1ty H97 Performance

Apparently Wendel's still around.

In an increasingly homogenised world, there are now established tropes for a gamer board. It must use a red and black colour scheme. The heatsinks must be angular. It must use an Intel or Killer E2200 network interface. And in this latest crop, the rebadged Realtek sound must have its shielding delineated by an LED-lit red line. ASRock's board doesn't deviate from the norm in this respect.

There's neither M.2 nor SATA Express on offer, ASRock banking that the average gamer has no use for them – and it may be right. A standard 4-pin power connector near the PCI-E 3.0 slot provides more stable power to your graphics card.

There are four USB 2.0 and four USB 3.0 ports on the rear, with headers providing another four USB 2.0 and two USB 3.0 if necessary. The board's audio block uses a 5x 3.5mm set up with a single TOSLink port.

ASRock's UEFI is expansively featured and easy to get around. It uniquely includes the amusingly named OMG, or "Online Management Guard", which is essentially BIOS-level Ethernet port scheduling, allowing you to lock down internet usage for kids.

As a bonus, ASRock tosses in a 3-month premium license to XSplit, as well as macro and DPI-customising software for keyboards and mice that may not have those features. It's light on the accessories, only including a single straight and right-angled SATA cable.

We like ASRock's H97 board. It's a lean and mean offering that absolutely holds its own, and does so at a compelling price point.

Verdict

While not as featured as other boards, this lean performer contains everything a gamer needs.



ASRock Z97 Extreme 4

Woah, dude. Gnarly.

Remember the 90s? Everything was "extreme". While we're not quite sure this board lives up to the same reputation, it most definitely deserves a place in your case.

We think ASRock has the balance right here. It's the most forward looking in our roundup, with a grand total of zero PCI slots. It is otherwise outfitted with three PCI-E 2.0 x1 slots, and three physical PCI-E 3.0 x16 slots. As usual, electrically things are different. With the first populated you get x16, with two populated you get dual x8, and with all three filled you're presented with an x8, x4, x4 configuration. Both M.2 and SATA Express get a showing.

Just like its H97 board, it includes a 4-pin power socket to provide more stable power to the GPU, but unlike that board the Z97 can support SLI in addition to CrossFire. Our favourite feature though? The seven segment display and physical power, reset and

clear CMOS buttons on the board. For troubleshooting, these things are godsend.

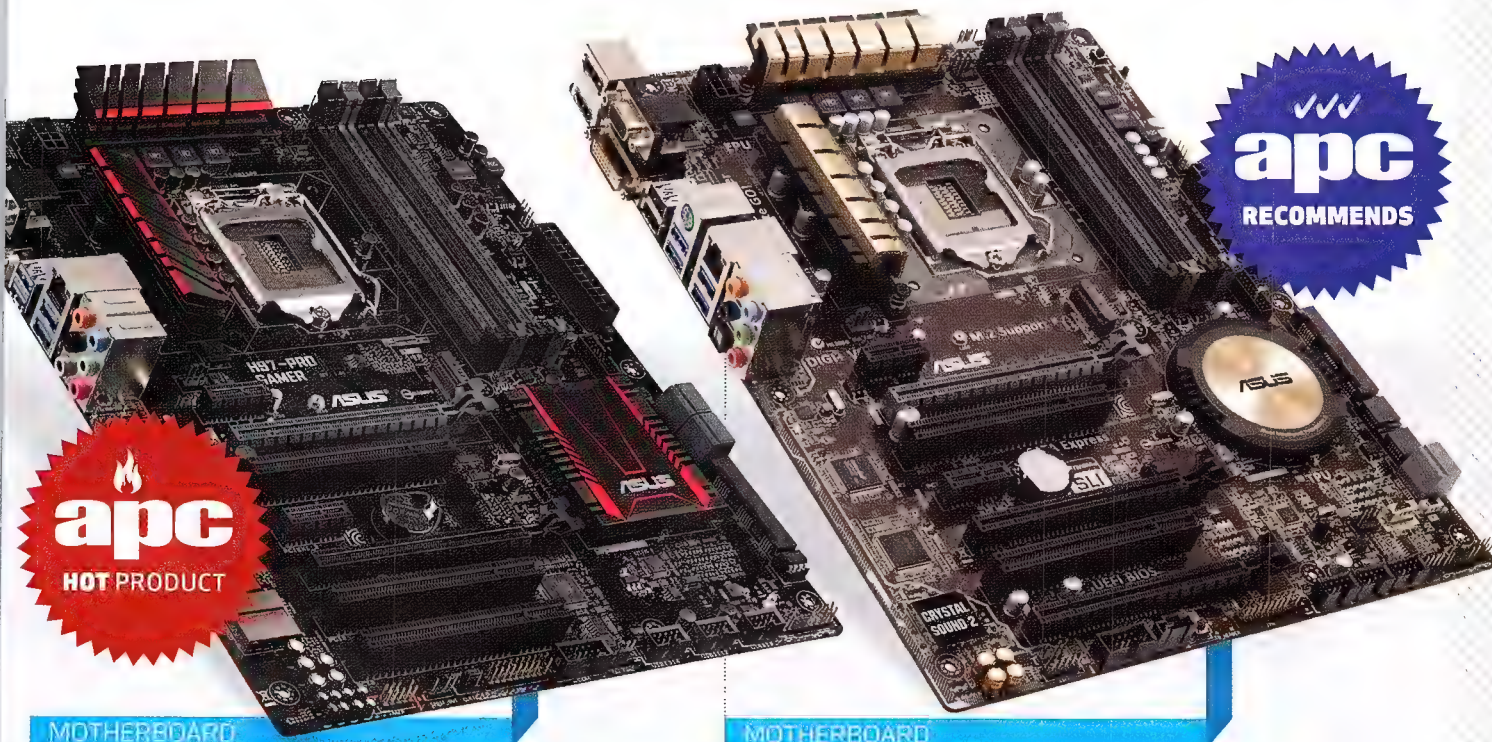
Finally at the rear, you get six USB 3.0 ports, as well as the usual USB 3.0 header on the board itself. Toss in all the video ports, up to six USB 2.0 ports, and a 5x 3.5mm + TOSLink sound block and you have a feature set that should pretty much cover anyone's needs.

It's been a long time since ASRock was that little manufacturer that made quirky and odd boards. If you're going Z97 under \$200, this is our pick of the bunch.

Verdict

With everything and possibly the kitchen sink too, the Extreme 4 is our Z97 choice for under \$200.





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ASUS H97-Pro Gamer

I said *all* the bells and whistles!

We're always amused when a vendor claims a board supports quad-Crossfire, despite not having the available slots. Even if you could find a PCI-E x1 graphics card these days, it's likely to be ancient and slow enough to be laughable. Not to mention the second graphics slot drops from PCI-E 2.0 x4 down to x2 if either of the PCI-E x1 slots are used. Ah, marketing.

Otherwise ASUS has provided a reasonably well connected board, with both an M.2 and a SATA Express port on top of the standard complement. If you choose to use the M.2 slot, you'll lose use both of your PCI-E x1 slots or one of your SATA ports, depending on the card inserted.

The board fits into the standard H97 gamer connectivity mould, with two USB 2.0 and four USB 3.0 ports exposed at the rear, along with three USB 2.0 headers and a single USB 3.0 header internally.

What does set ASUS' board apart from other H97s is the ability to adjust the ratio limit of K-series processors, allowing for a little bit of overclocking.

In addition to Intel Ethernet, ASUS has included its GameFirst II software, supplying basic QoS to make sure applications of your choice receive the best quality internet connection. Two straight and two right-angled SATA connectors are included in the package.

ASUS provides a full featured, flexible board in its H97-Pro Gamer. We'd honestly go Z97 if you're going to be overclocking, but this is still a very solid board on offer.

Verdict

If you need more options than ASRock gives you with the Fatal1ty, ASUS has you covered.



ASUS Z97-A

A touch of class.

There's something to be said for the understated. ASUS' subtle gold/bronze on black/brown look, with low, round heatsink actually manages to set itself apart from the pack.

There's a physical power button on the board, which is always welcome in our books. The expandability is rather decent too, with three full length PCI-E slots available.

As usual bandwidth is limited here; occupy slot one and it'll run at 3.0 x16. Occupy slot two as well, and both will run at 3.0 x8. The third only runs at 2.0 x2, while the dual PCI-E 2.0 x1 slots share bandwidth with the included M.2 slot. If you have truly old equipment lying around, two PCI slots are available. Should it come to pass that SATA Express gains popularity, a port is provided as well.

As tends to be the Z97 hallmark, in addition to CrossFire the Z97-A is capable of SLI, should you be of the multi-GPU ilk.

Things are otherwise pretty standard, including the usual rebadged Realtek sound that gets a fancy name because it has EMI shielding, and an Intel gigabit Ethernet port. There's a 5x 3.5mm audio block here with an integrated TOSLink port, every video connection you can squeeze out of a modern day PC, and enough USB ports to fry a buffalo, although not enough to cause a star to implode like MSI's Z97 U3 Plus.

It's pretty hard to go wrong with the Z97-A, and ASUS' reputation makes it a safe choice.

Verdict

ASUS's experience shines through in this well-made board. For those who need to have it all.





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\$149 | WWW.GIGABYTE.COM.AU

Gigabyte GA-H97-Gaming 3

Same, but different.

Gigabyte's H97 offering may look similar to every other H97 board, but its extra polish puts it ahead in the value stakes.

The motherboard vendor has managed to squeeze both M.2 and SATA Express onto its board, with the same bandwidth caveats as ASUS. Unlike its competitor it has opted to include Killer's E2200 network interface over Intel's. Although performance differences are academic, more interesting is the included software, which allows for per-application bandwidth priority settings, and blocking if necessary.

The included SoundBlaster X-Fi MB3 software suite is appreciated, which elevates Realtek's sound beyond its usual mundanity. Included in the suite is Creative's Crystalizer, EAX support, virtual surround sound for headphones, Scout Mode for gaming (allowing you to hear an enemy's footsteps from further away) and

VoiceFX, which alters your voice in real time – presumably to annoy as many people as possible on the Counter-Strike server. Accessories are limited to two straight and two right-angled SATA cables.

Gigabyte's UEFI is a bit of a design mess, with three separate interfaces making it difficult to find exactly what you want. Like other boards it includes a feature to set up your own custom page with quick links to your most-used features, we suggest you do this as a matter of priority, or simply use the classic interface as much as possible.

Gigabyte's price point puts it in direct competition with ASRock, but for our money its extra features make it our preferred H97 board.

Verdict

Our favourite affordable H97 board, winning out on sheer features for price.



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Gigabyte GA-Z97X-Gaming 3

If you're on to a good thing...

Considering they have nearly the same name, it should be no shock that the Z97 variant of Gigabyte's Gaming 3 board looks incredibly similar to its H97. Peer a little deeper though, and the differences start surfacing.

Of course you have the SLI support, helped along by the board's additional full length PCI-E slots, configured in 3.0 x16, x8, and x4 respectively. These share bandwidth in an identical manner to ASUS' Z79-A. Only a single PCI slot is present, affording space for three marginally more useful PCI-E x1 slots. M.2 and SATA Express are both in play.

The rear IO panel is unique. Four USB 2.0 ports are exposed at the rear, leaving two headers internally. But perhaps more curious is the inclusion of dedicated individual PS2 ports for keyboard and mouse, something we haven't seen for years.

Gigabyte's gaming

trappings are here, including Killer's E2200 NIC and Creative's Sound Blaster X-Fi MB3 software. Just like the H97, the sound area is demarcated by a red LED-lit line. Also like the H97, the UEFI is in need of a usability overhaul, stick with the classic interface.

Like every Gigabyte board we can ever remember, the Z97X features a dual BIOS. If something goes horrendously wrong during firmware flashing or otherwise, it can switch to the backup for recovery. Accessories include two right-angled and two straight SATA cables, along with a case badge.

The Gaming 3 is a solid Z97 board – we just think it's pipped at the post by ASRock.

Verdict

A solid entry from Gigabyte, although this time we think competitors have the drop.



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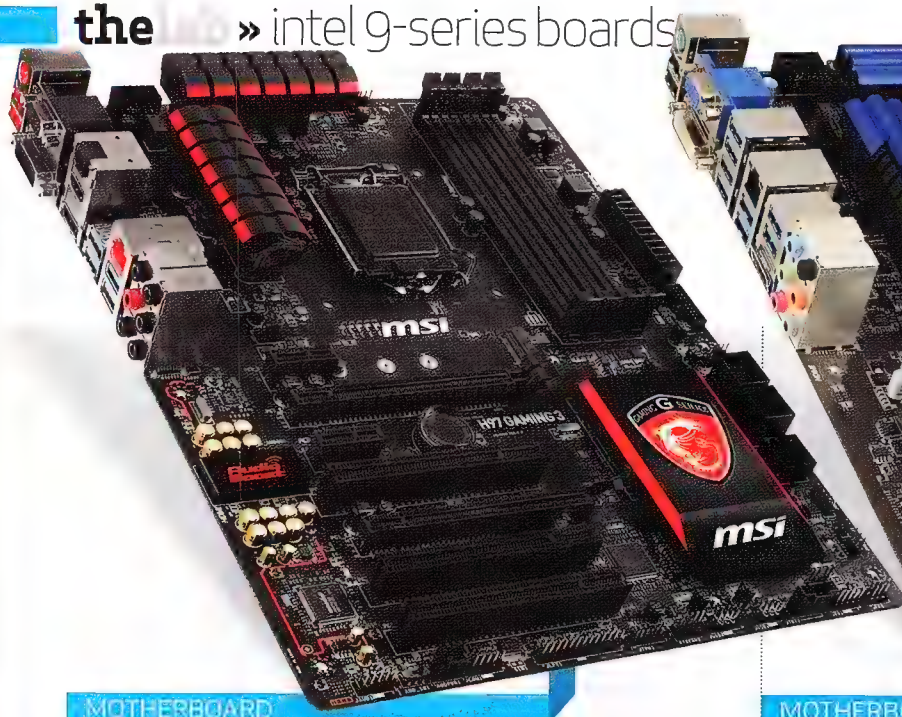
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MSI H97 Gaming 3

What's black and red and gaming all over?

Not content to just conform to the standard gaming colour scheme, it seems MSI has inherited Gigabyte's naming regime as well. Given BMW beat them all to the 3, 5 and 7 model tiering long ago, perhaps we can't be too harsh – it's just that it's generally a good idea to stand out from your competitor.

The colour scheme continues on the rear IO panel, with the USB 2.0 ports and Killer E2200 gigabit NIC coloured red. The audio block, consisting of 6x 3.5mm jacks, has also been coloured, which confuses things greatly. While Realtek has long offered user-assignable jacks, colouring five jacks black and one red is a usability nightmare for a beginner.

Another frustration: MSI doesn't individually label the pins on its case header, meaning you will need the manual to wire the board to the case successfully.

Realtek's audio chip is improved by Creative's Sound Blaster Cinema 2 software, which features a small subset of the features from the more powerful X-Fi MB3 suite. M.2 is present here, but there's no SATA Express to be found.

MSI includes a straight and right angled SATA cable in the box, as well as a four pin PSU to three pin fan adapter. A huge MSI Gaming case badge is included, along with a bunch of stickers for labelling cables and door hanger that says "I'm sorry busy gaming" on one side and "I'm not here" on the other side.

It's hard to get excited about the Gaming 3. While the slip ups are minor, it does nothing to inspire.

Verdict

A standard entry with a few missteps. There's better value to be had elsewhere.



MSI Z97 U3 Plus

USB. Oi. Oi. Oi.

The U3's claim to fame is its rather insane amount of USB 3.0 ports. It doubles the amount typically found on the rear IO panel to eight, while providing another two headers on the motherboard for a total of twelve. Add the two USB 2.0 ports on the rear and another two headers on the board, and you're looking at 18 USB ports on the one board. If you have this many devices, you may need help.

Despite the mountains of USB on the rear IO panel, MSI still manages to fit in VGA, DVI and HDMI, a split PS2 connector and a 6x 3.5mm audio block. Out of all the motherboards in the roundup, this is the only one to cheap out on gigabit Ethernet, opting for Realtek instead of Intel or Killer. It is also the only one to not provide optical audio out.

Expandability is slightly disappointing: three PCI slots, a PCI-E 3.0 x16, PCI-E 2.0 x4, and two PCI-E x1

slots that won't function if the x4 is populated.

The official specs mention CrossFire, but SLI is nowhere to be seen. For an extra \$10, the G55-SLI will afford you this capability. M.2 is there, but no SATA Express.

Once again MSI has neglected to individually label its case header pins, leading to a frustrating wiring experience.

While the U3 is the cheapest of the Z97 boards in our roundup and thus affords some forgiveness, you lose a lot of functionality along the way. We think there are better options out there.

Verdict

While the U3 Plus is cheaper than other boards, you miss out on headline features too.



disc contents

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ISSUE 406, SEPTEMBER 2014

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- The software packages on the APC disc have different system requirements. Software is included on the disc for Windows XP, Vista, 7 and 8.

BEFORE INSTALLING

- Check the disc using a virus scanner complete with the latest antivirus data updates. The disc was checked before burning, but new viruses are being discovered all the time.
- Back up any important system and data files. It is not recommended that the software contained on these discs be installed on production machines.
- If you have any questions regarding the use of the APC disc, click the 'Help' button at the top of the screen.

USING THE DISC

- Insert the disc into a CD/DVD-ROM reader or burner and your web browser should automatically load the interface. If not, launch your web browser and load the default.html file from the root directory of the disc.

HELP

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- APC provides no technical support for this disc or any software provided on it.

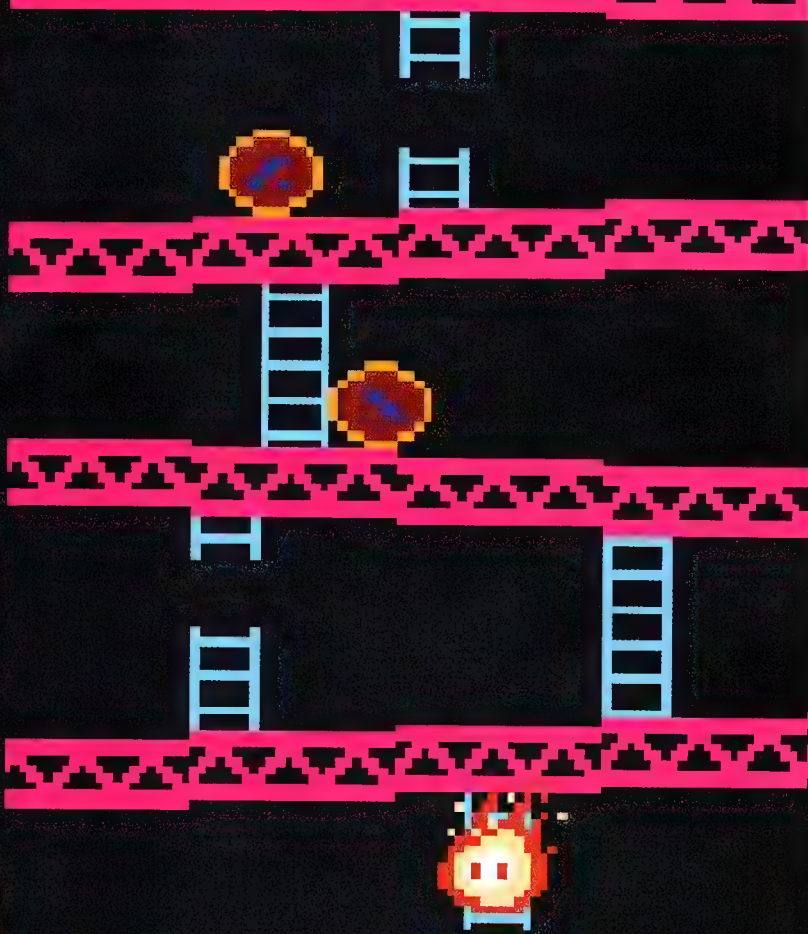
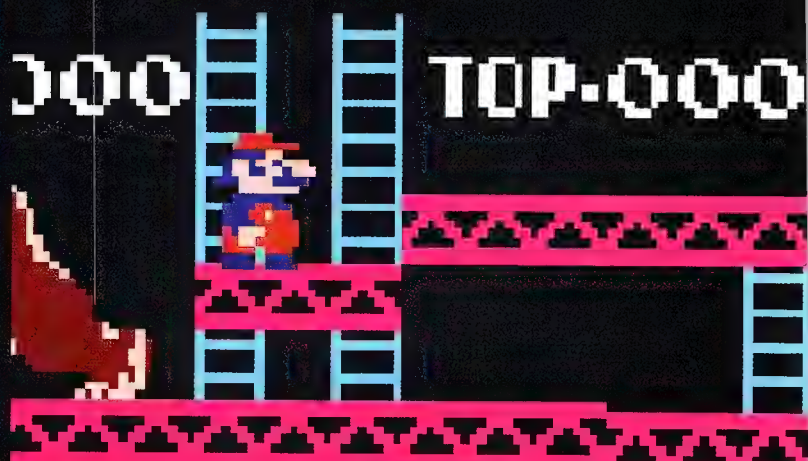
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GAME CHANGERS



Richard Moss looks inside the ultra-committed world of the hackers reconfiguring old console titles to make them do things their creators never imagined.

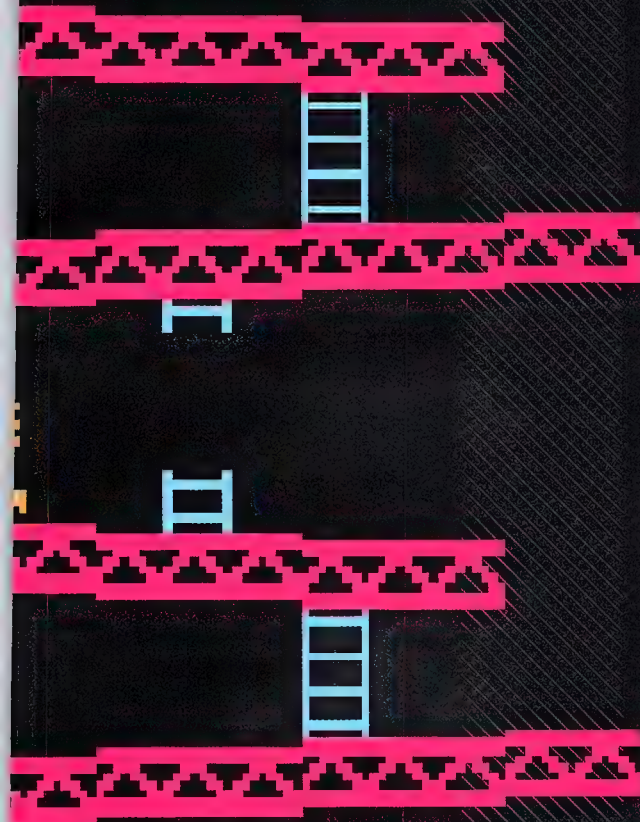
When a serious injury ended Phil 'Keson' Earley's professional wrestling dream a few years ago, an N64 game called *WWF No Mercy* helped to pull him out of his depression.

"It was something I was good at, and at the same time I could talk wrestling with folks," he says. However, *No Mercy* was the last of its line. Its developer, AKI Corporation, lost its contract to develop THQ's wrestling games, and so Earley set about hacking and modifying the game's ROM file to add moves and wrestlers.

He helped build a fan community, Old Skool Reunion, where other *No Mercy* hackers could swap notes on how best to dismantle and reassemble a game that was never built for modification.

In so doing, Earley joined a burgeoning underground movement that dates back to the mid-'90s, when emulators for old consoles first spread across the emerging internet. In message boards and forum threads, curious fans started to wonder if they could tinker with games that had been locked away within the ROM chip on cartridges the way they could

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modify PC games of the era. ROM hacking shares much of the same spirit of PC game modding, except it's never legitimate, and usually mired in hexadecimal maths.

The scene has many dispersed clusters of special interest hackers, such as Old Skool Reunion, but operating as a hub is **romhacking.net** (AKA RHDN). RHDN's founder, Nightcrawler — who requested that we omit his real name — was there soon after the beginning. "We were working on inaccurate ROM dumps of *Super Mario Bros* with pencil, paper and a hex editor," he

recalls. "There was no central location [where you could] learn the trade. You were lucky to find some notes someone posted on their personal web pages on what they were doing."

ROM hacking was uncharted territory, and Nightcrawler was among its earliest explorers. It's a very different state of affairs today, with thousands using advanced debuggers built into emulators for most of the '80s and '90s game consoles, able to access detailed technical documents and armed with powerful tools such as FuSoYa's Lunar Magic Super Mario World level editor. ROM hacking has grown up, and the results are quite startling.

Earley and a handful of friends are four years and a fraction of the way into developing *Showdown 64*: an enormous *No Mercy* hack that, thanks to emulator Project64's limitless allowance for immensely long GameShark codes, will more than quadruple the playable wrestler roster to somewhere in the vicinity of 400. The idea is to squeeze in every single wrestler the team has ever heard of, with characters dating back to the '50s, and to remake the arenas. Each wrestler gets his or her own custom skin and moveset, with the former crafted in Photoshop and the latter generated by splicing together existing move animations with help from community-created OpenOffice tools. If they're lucky, Earley jokes, the project might be finished by the time he retires.

Earley points to a hacker with the handle wldfb as the mastermind of *No Mercy* hacking. "I don't know how he finds values," Earley says, "but he's managed to change a few fundamental things in the game [and] fix bugs." It was wldfb who figured out that you could expand the roster by modifying the extra attire slots every wrestler has, and it was wldfb who made *WrestleMania* legend The Undertaker nigh-on unbeatable — just like his real-life counterpart.

But between Old Skool Reunion and its many now-defunct forebears, *No Mercy*'s hacking scene is much bigger than a few individuals. "I'm willing to say that *No Mercy* has been hacked, modded, redone, ripped apart and just overall had more work done to it [by fans] than any other N64 game," Earley

says. "It's unreal. There are guys that still dig through bare code looking for values and how we can manipulate them, just to get one more new thing in the game."

Like digital archaeology, ROM hacking is big on discovery and exploration, except with an added element of creation; as RHDN staff member and former translation ROM hacker Markus 'KaioShin' Hildebrand says, it's a thrilling kind of detective work. "Every script control code deciphered and every menu understood and changed is a little puzzle on its own, with a 'Eureka!' moment at the end."

Such hackers dig carefully through executable code in search of secrets and a comprehensive understanding of how the game works, then they twist and reshape that knowledge to their own ends, whether it be to give Mario a new hat, make Pauline the hero of *Donkey Kong*, drop Sonic on the planet Zebes, or update player rosters and expand mechanics.

The fact that NES hit *Tecmo Super Bowl* is nearly 23 years old and has long been surpassed by the likes of EA's Madden series isn't lost on Dave 'bruddog' Brude. But he loves its simplicity, and he's been actively engaged in tournaments — first with friends, then with strangers over the internet — since the very beginning. Brude gradually waded into the hacking side of things via online tournaments and leagues played with emulators, with over half the community participating through dial-up internet connections.

"One of the things that bugged me with the original *Tecmo Super Bowl*," he says, "was the fact that it is nearly impossible to return interceptions, because the defender is too slow to deal with offensive players that become defenders on interception returns." Most of Brude's hacks overcome issues of this nature. They fix the flaws that drive some players crazy, or add a touch of realism where it was lacking before.

The *Tecmo Super Bowl* community, meanwhile, collaborates on a yearly roster update complete with correct names (and all 32 of the teams, too, thanks to an older hack by cxrom that overcame the original 28-team limitation). These dedicated fans have a multitude of tools and notes to



Girl power

Game designer Mike Mika's three-year-old daughter wanted to play *Donkey Kong* as Pauline, with Mario as the damsel in distress. She couldn't, of course, because the game wasn't designed that way. But it nagged at Mika, so he found out how to hack the NES version's ROM, redrew and replaced the sprites, swapped the 'M' on the bonus indicator with a 'P', and put a work-in-progress video up on YouTube. The video spread like wildfire across the internet while Mika was showing his daughter the hack the next morning, his work having been picked up as a feminist symbol and a statement that girls can be the hero, too.

assist them. "We have powerful tools, such as the FCEUX emulator, that allow inline debugging, breakpoints, the ability to see what part of the ROM has been accessed, the reloading of game states and so on," Brude explains. "Today, we also have parts of the game disassembled and [the code] commented." The group developed tools to make alterations such as roster updates possible for anyone, too, even the code-illiterate.

When it comes to opening ROM hacking up to a wider audience, few operate on the level of FuSoYa. His *Super Mario World* level editor, *Lunar Magic*, first appeared in 2000, rapidly gathering attention and pulling the scene's focus away from NES Mario games. It came from humble origins, its idea born of a rudimentary map editor that FuSoYa created simply for translating street signs in Japan-only Super Nintendo RPG *Pretty Soldier Sailor Moon: Another Story*.

It blossomed. A dedicated *Super Mario World* hacking community soon appeared, mostly built around *Lunar Magic*, and FuSoYa's tool became the perfect entry point for ROM hacking. "A casual user can sit down with the program and make a basic level within minutes," he explains. "But if you want to get a little more into it, you can replace the graphics and use other tools to insert pre-coded blocks and sprites that customise the gameplay. And advanced users can go even further by learning assembly and coding their own blocks and sprites."

People have hacked in marriage proposals, designed levels that play themselves, created custom graphics and

music and much more. As a result of all this, the game endures. *Lunar Magic* has been regularly updated throughout its life, but it's still just a level editor for a 24-year-old videogame released on the launch day of Nintendo's Super Famicom.

"If someone had told me back in 2000 that, over the next 14 years, this many people would have used *Lunar Magic* to create countless *Mario World* hacks and would still be doing so, I wouldn't have believed them," FuSoYa admits. "Sure, Mario is popular, but 14 years of *Super Mario World*? When the editor was first released, I figured I'd just spend a couple of months touching things up in the program and it'd be done, and people would play with it for a couple of years. Yet here we are, and it's still being actively updated and used."

He suspects the appeal rests partly on *Lunar Magic*'s easy extensibility, and partly on Nintendo's penchant for re-releasing the game on newer platforms, thereby exposing it to new audiences who in turn take up hacking the game.

Quality is an enduring factor, too. There are plenty of fans prepared to argue there has never been a better 2D platformer than *Super Mario World*, nor a better wrestling game than *No Mercy*. "Whenever I would buy a new *SmackDown Vs Raw* or something like that," Earley recalls, "we would instantly compare it to *No Mercy*, because I think the mechanics of it are just perfect. I'll go on forums or even Reddit [and] see people talking about it. 'Isn't it great? Wouldn't it be cool if they'd just make a new game based on the AKI engine?' Most of the time, that's where I snag new players: 'Well, you can't get a new *No Mercy* game, but there's

new moves and new rosters; people have been updating this sucker since 2003. It's kind of a testament to how damn good that game is that people are still doing it."

It helps that the professional wrestling scene is splintered, with dozens of rival promotions that will never appear together in a licensed videogame, but that can all be hacked into *No Mercy*. "Since you don't have to worry about likeness rights or anything like that, you can put anybody you want in there," Earley says. "You can have any dream roster."

Earley's motivations run deeper than that, though. "I think anybody who's ever loved a videogame has kind of wanted to make one," he says. "For me, I get a strange high from being able to take something like a game I love and manipulate it and change it. It kind of brings you closer to the game in a weird way. You'd be sitting there and you're playing a game and you're like, 'You know what? I don't like this aspect. I wish, if that thing would change – if this one little

Trigger hack *Crimson Echoes* came into existence. Intended as an unofficial sequel that would continue the story where Square left off, *Crimson Echoes* was hotly anticipated far beyond the hacking community, and its development had almost finished when Square Enix swooped in with a cease-and-desist letter in 2009, mere weeks before the scheduled release. Lacking the coffers to handle a legal fight, the developers promptly abandoned the project and pulled all the associated materials offline. In January 2011, however, one of the team anonymously leaked a beta ROM online, ensuring that all of the team's work would not be wasted.

A new group of fans known as the Ruby Dragoons used this beta ROM to carry on development under a new name, *Flames Of Eternity*. The Ruby Dragoons initially planned to just fix the bugs but soon decided to add in even more areas to explore and make a handful of changes to the plot. For the erstwhile project lead, Giro –

"For me, I get a strange high from being able to take something like a game I love and manipulate it and change it"

thing would change – man, it would be a lot more fun to play.' And then when you figure out, 'Hey, I can do that,' that's huge, you know. It's like this explosion in your brain."

Nightcrawler is driven more by preservation. A great many ROM hacks are about translating games for other audiences, often Japanese titles into English, and as such he considers his work to be setting certain past injustices right. "Many games were never released to certain regions simply because naïve executives [thought they] couldn't handle complexity," he says. "For general ROM hacking, it's about letting the classics live on."

"ROM hacking allows bugs to be fixed, new levels to be created, abilities to be enhanced, or even [for] completely new works running on a classic game engine. These types of things allow classic games to continue to grow and live on long after their creators and publishers have abandoned them."

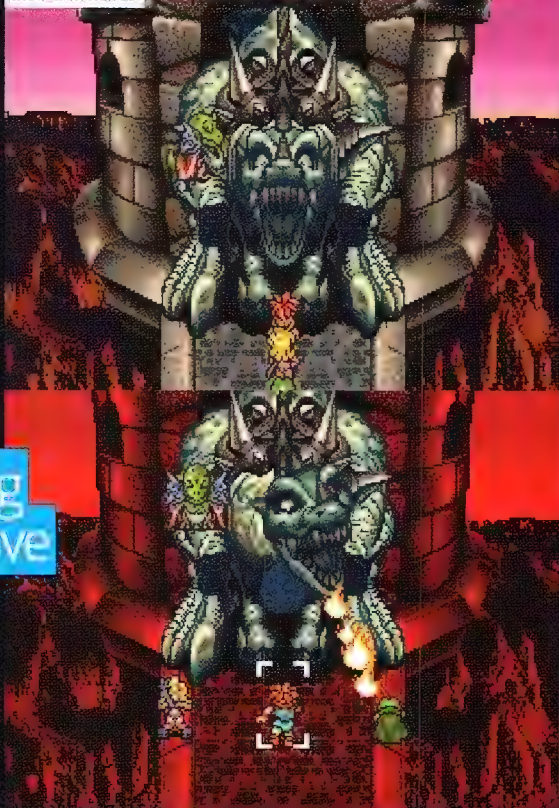
This is exactly how *Chrono*

whose real name we've omitted because he's currently in service for the US Army – it was a way to get his mind off the war during a deployment in the Middle East. Giro grew up with *Chrono Trigger*, and relished the opportunity to have a hand in continuing its story. "Who wouldn't want to take a time machine and have a chance to save the world?" he wonders. "Who wouldn't want that chance to be The Doctor?"

Giro stepped down as project lead last year to spend more time with his family, and an anonymous fan who calls himself imMUNEity took over the reins. imMUNEity takes a defiant stance, declaring that he'll continue development offline if Square Enix squashes the project again. He's determined to continue *Chrono Trigger's* story. "In the original *Chrono Trigger*, you never get a chance to explore the future after you've defeated Lavos and saved the world," he says. "My favourite part of *Flames Of*

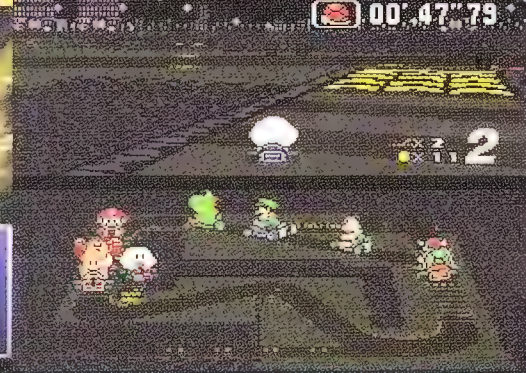
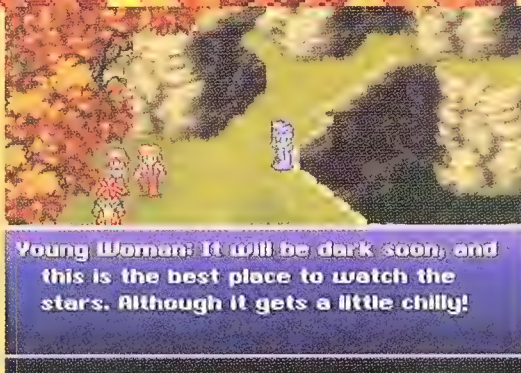
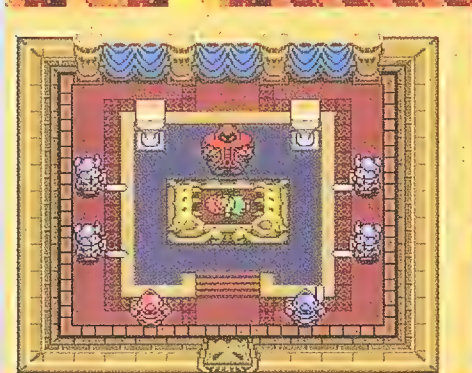


While *Chrono Trigger* fans wait for an official sequel to the much-loved collaboration between Square and Enix from 1995, hacking groups like the Ruby Dragoons have taken matters into their own hands.



Marry me

Phill 'TheRealPfhreak' Spiess was neither the first nor the last to hack a marriage proposal into a ROM, but his *Chrono Trigger* proposal from October 2008 is perhaps the most famous of the lot. Spiess fused the Denodoro Mountains area in the game (which his then-girlfriend was playing at the time) with the real-life site of their first date, mixing in references to their favourite memories, lyrics from her favourite song, and even her cat (which follows Crono and co around). It wasn't until she saw her name on the screen and looked across to see Spiess on one knee, holding an engagement ring, that it occurred to her this area was not in the original game. You can watch a playthrough of the hack on YouTube. Oh, and she said yes.



New game+

Many enterprising ROM hackers have created total conversion hacks of games that don't simply change a few things but completely overhaul the experience. Here are six of the best.

Chrono Trigger: Crimson Echoes/Flames Of Eternity

Both *Crimson Echoes* and its illegitimate spawn *Flames Of Eternity* offer fascinating glimpses of what a direct *Chrono Trigger* sequel could have been. These games also represent a portal for those who have long desired more than a peek into life during each epoch.

The G.P. Factor: Sonia and Silver

Nintendo systems get the lion's share of attention in the ROM hacking scene, but we'd be remiss to leave out this fantastic Sonic hack, which pairs Sonic's Underground-spawned sister, Sonia, and time traveller Silver in a familiar quest to stop Eggman Nega from destroying the world.

The Legend Of Zelda: Parallel Remodel

A Link To The Past has been hacked to bits at this point, but the most impressive unofficial offspring is the remodelled version of SePH and Euclid's popular *Parallel Worlds*. It tones down the difficulty and rejigs the dungeon designs, making it a must-play for any Zelda fan, even if it still lacks some of the magic of the Nintendo original. SePH is currently working on a sequel, *Parallel Universes*, which links Zelda to a multitude of other game franchises.

Mario Adventure

Super Mario Bros 3 gets much more than just a fresh coat of paint in this adventure, which features modified graphics, well-designed new levels, four new power-ups, random weather patterns, infinite lives and more. One *Mario Adventure* follow-up was left unfinished, but a third one is in development.

Super Mario Star Road

It takes immense skill to complete *Star Road*'s 30-odd areas, but the variety on offer makes up for the excessive challenge. The creative level design pushes *Mario 64*'s engine to its limits, while some of developer Skelux's touches even feel worthy of Nintendo itself. A DS version is in development, to be followed by a sequel.

Mario Kart 8

For those who insist that *Mario Kart* peaked at the first entry, R is a godsend. It overhauls all the graphics — menus included — and modifies all the original courses, primarily by adding alternative paths and more shortcuts. It also replaces the maligned Toad with Kirby.

Eternity is that the saved future is wide open for exploration."

Even after having diverged slightly from and greatly expanded on *Crimson Echoes*, the version of *Flames Of Eternity* that imMUNEity inherited was ripe for further development.

"I am getting to add a lot of what I felt was missing from the original game into this one," he says.

In some ways, it's the fans who own *Chrono Trigger* now. Square Enix still retains the copyright, a looming threat for any burgeoning fan spinoff, but the story, the world and the characters all live on with those who have been clamouring for a sequel for 20 years (the tenuously connected *Chrono Cross* and *Radical Dreamers* notwithstanding). "I honestly feel that Square Enix will never make a true sequel to *Chrono Trigger* or *Chrono Cross*," Giro says. "If they wanted to, they would have [done so] already. It's up to the fans to continue and expand upon the universe and the story. Maybe years down the

contrast to my present standards," he says.

Skelux also thought the hack would go no further than the general ROM hacking community. "I would have put more work into it if I anticipated how much attention it would draw." The Mad Musical Mess level, for instance, lacks polish and is far too hard. "It doesn't even resemble a complete level. I didn't even add strings to the guitar, despite having a string texture in the level."

Now he's trying to set things straight. *Super Mario Star Road* is being ported to DS and, much like Nintendo's *Super Mario 64* DS port, it's getting tweaked and polished (or completely redesigned, in the case of Mad Musical Mess) to better suit the dual-screen handheld.

When that's done, he'll shift his focus back to making the *Star Road* sequel. "I feel that many people would enjoy playing through more of my designs," he says, "and I can be more considerate of details such as difficulty ramps this time."

'The more people we have in the community, the more fun remakes of these old classic games there are to play'

line, it will return to Square Enix, but for the time being the best stories are well-fleshed-out fan mods."

Not all ROM hackers are obsessed with their game of choice. A network technician who goes by the handle Skelux made a name for himself in 2011 with the *Super Mario Star Road* hack, which squeezes an entirely new 3D Mario platformer into the Mario 64 ROM. But he feels "no particular attachment" to the original game. "No one had really touched on hacking any other 3D platformers at that point," he says, so he thought he'd kickstart the scene, first with a single new level and then with a whole new game.

Star Road introduced 30 new areas, nearly 50 new audio tracks and 120 stars to collect in an imaginatively designed world that some players insist is better (and much, much harder) than *Mario 64*. Yet Skelux himself is unsatisfied. "I find some of the original *Super Mario Star Road* designs embarrassing in

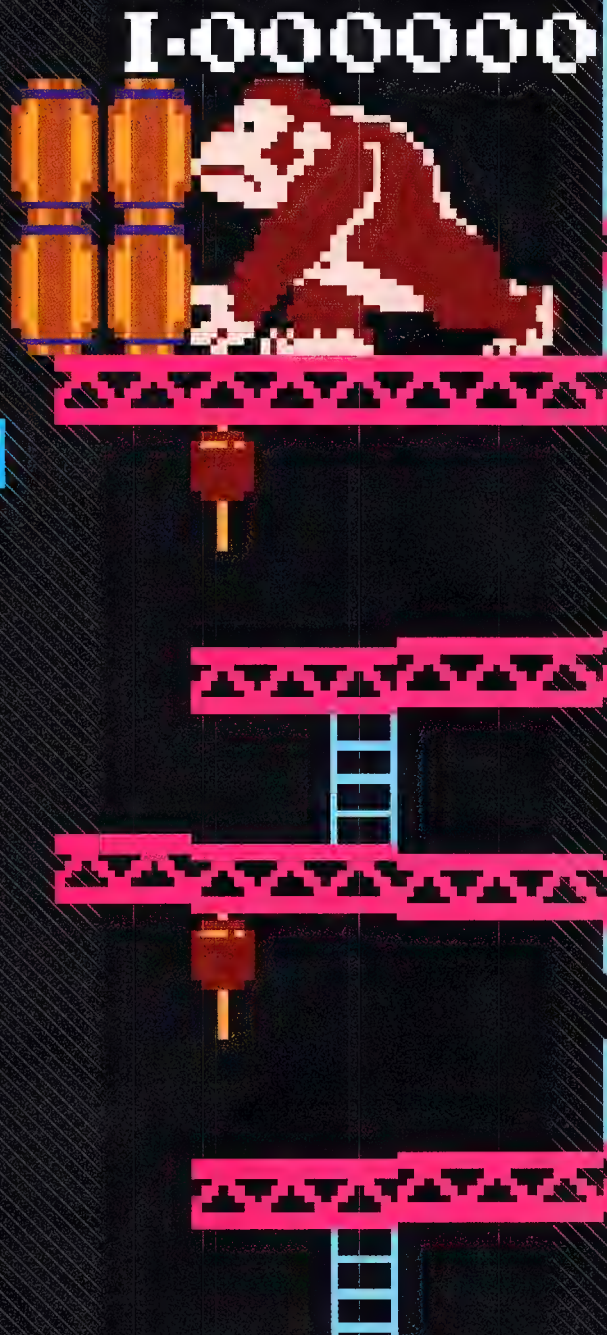
It's tough work, though.

Skelux finds coding easy, while creative designs and plot points don't come so naturally. "Conceiving of that many unique ideas is very difficult for me, and I also want to avoid just repeating the same type of paths I used in other levels. I waste far too much time just rotating my level model in [Google] SketchUp and wondering what I should do next."

It's all done in the spirit of keeping the game alive and encouraging others to hack games too. "The more people we have in the community, the more fun remakes of these old classic games there are to play," he says. "It breathes new life into something that could have died long ago." ■

Mother tongue

Translation ROM hacking has lost much of its glamour now that many of the most highly sought-after projects have been completed, but Markus 'KaioShin' Hildebrand believes there's still plenty of exciting stuff to come. "I believe it will only be a couple more years before everything [that was] formerly Japan-exclusive for NES and SNES will have been translated," he says. But he's eagerly anticipating the crowdsourced translation for PlayStation strategy-RPG *Super Robot Wars Alpha* and an on-again, off-again translation of infamous Dreamcast in-joke *Segaga* that showed new signs of life last year.



howto

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

WINDOWS

DRIVER WOES

Ever since I updated Windows, my desktop window manager has stopped working. I was without the internet for a couple of months due to service provider difficulties, which led to one big update needed. The update didn't give any error messages, but ever since then, every time I start my PC up, I get a message saying 'Desktop Window Manager has stopped working'. I tried rolling back the system to when it worked and carried out the update again — same issue.

I don't think that it can be hardware related, as it used to work before the update. But hey, I'm not the doctor; I'm a mere patient.

Anton Meyer

The Desktop Window Manager was introduced with Vista as a way of compositing the windows from different apps to produce Aero effects such as transparency and the 3D window stack. Nowadays it has expanded its role to coordinate all graphical hardware acceleration for desktop applications. You can run

Windows without it, but everything will be slower and uglier.

From the error message screenshot you included (for which you get bonus points), I see that the DWM is crashing due to a 'BEX' event. This stands for Buffer EXception, which is an interesting detail, but doesn't really get us any further towards a solution.

What probably happened here was that something in the DWM changed in the update, and that is causing your current graphics driver to throw the buffer exception. I know, "update your graphics driver" is the most boring answer in the world, but we can't help that in this case, because it also happens to be the right one.

Luis Villazon

HARDWARE

ABSOLUTELY NOTHING

So I got new parts for my PC: a Gigabyte GA-B75M-D3H mobo, Intel Celeron G1620 CPU, Gigabyte GT 630 2GB graphics, 4GB DDR3 RAM and my old 450W PSU, hard drive and DVD writer. So I connected everything up and nothing happens — absolutely nothing. I made sure everything

was connected and in place. Still nothing! I then took it to a friend and tried his PSU but still nothing!

After that we tried my PSU again and when we started it up a red light next to the power button flashed. That was the first and last time it happened. I sent the motherboard back and it was returned 'faultless'. Can you help with this mystery?

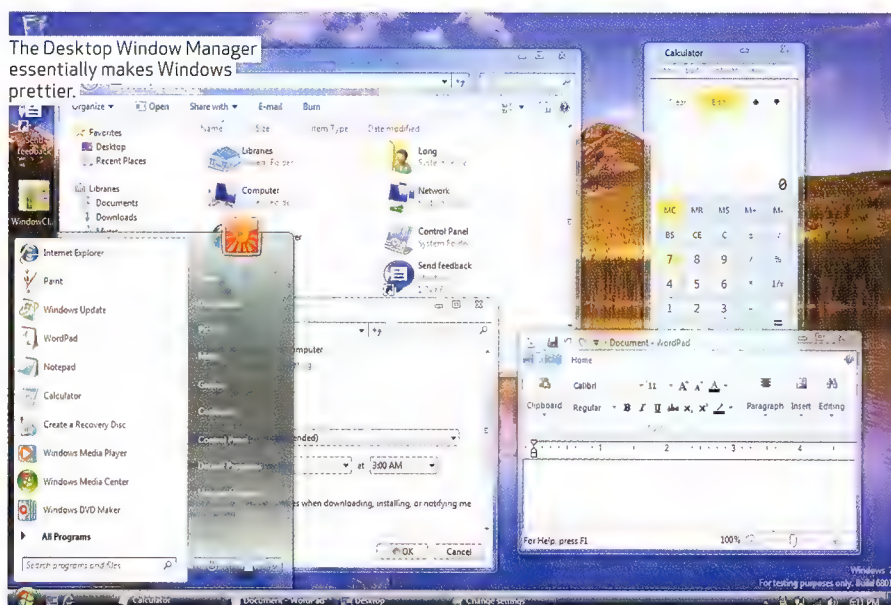
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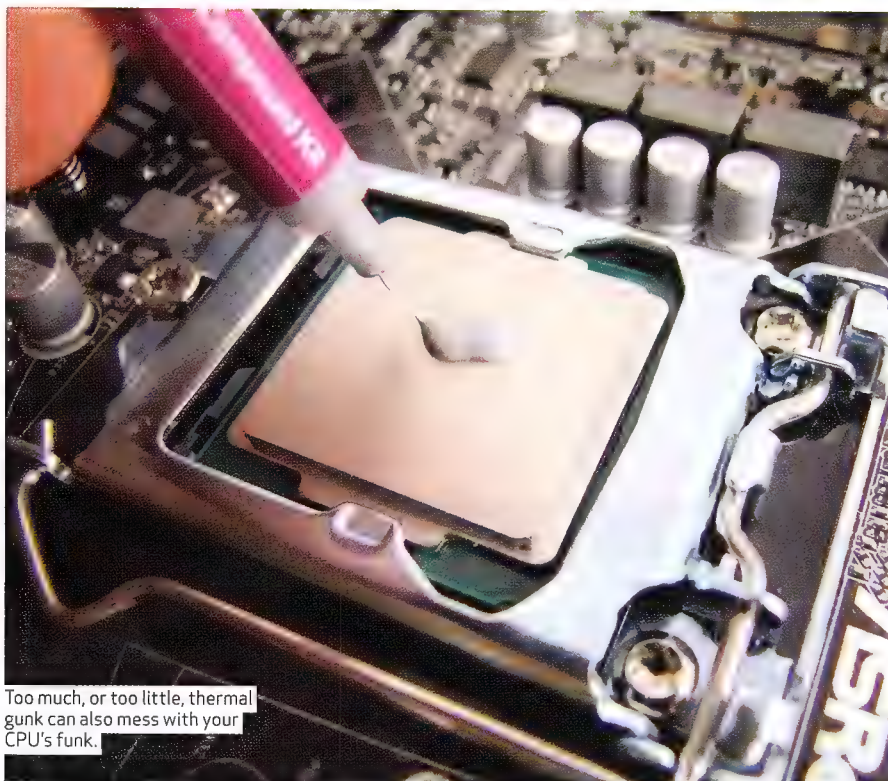
When you press the power button on the front of the case, what is supposed to happen is that the green wire on the ATX motherboard connector is shorted to ground momentarily. This signals the PSU to spin up the fan and the main power rails. This in turn provides power to the motherboard and CPU but the timer chip stops the CPU from actually initialising by continually resetting it. Once the PSU decides that the output voltages have stabilised, it pulls the grey ATX wire to +5V to announce that it is all systems go, and the motherboard releases the reset line. This allows the CPU to initialise and it begins executing the power-on self test code in the BIOS.

Since you aren't even getting a beep code from the POST, your PC is failing somewhere along this road. Exactly where depends on your definition of 'absolutely nothing'. If the PSU fans are spinning then it could be that the grey 'power OK' wire on the ATX header is disconnected or shorted, or the CPU itself might be faulty. If the fans don't spin at all, or they spin and stop almost immediately, then the problem lies with the green 'power on' wire (pin 14). Try grounding this wire manually by touching it briefly to the metalwork of the case chassis. If that starts the PC, then the fault could lie with the power button itself. Try swapping the power and reset buttons over.

Oh, and let's not forget to check the obvious as well. Have you tested the fuse in the power lead?

Luis Villazon





Too much, or too little, thermal gunk can also mess with your CPU's funk.

LINUX

THE BEST SSD SETUP FOR LINUX

I have just purchased an SSD — what's the best way to set it up for use with Linux? What settings should I use for partitions and for TRIM?
Ram

There isn't much different to be done when setting up an SSD compared with a spinning drive these days. Partition alignment used to be the most important consideration. It still is, but a recent version of fdisk and parted default to safe alignment that works with SSDs as well as the newer hard drives with 4K block sizes. Ext4 is a good general purpose filesystem that's just as suited to use with SSDs as it is with hard disks, although BTRFS has some features specific to SSDs. Whether you want to use an experimental filesystem for your data is your decision. The last time I spoke with someone from SUSE about it, and they are the main proponents of BTRFS, they recommended using it for the OS with ext4 for data, although they were talking about enterprise customers where data integrity is critical.

Some still consider wear from writes to be a problem with SSDs, but most of the recent studies suggest that an SSD is capable of outlasting a spinning drive. However, it won't hurt to add noatime to your mount options in /etc/fstab. Most distros mount some frequently written areas, like /tmp, to tmpfs anyway. TRIM can be handled automatically or manually (usually through Cron). To do it automatically, add relatime,discard to the mount

options in /etc/fstab, but do not do this for the root filesystem, or any other frequently written filesystem as it is reported to cause performance degradation over time. It is fine for less critical and, more importantly, less frequently written filesystems. The safer alternative is to call the fstrim command from Cron. To trim the root filesystem, you'd run: `fstrim /`

Once or twice a day, no more. If your computer is always on, schedule it for times you will not be using it. You will need a separate fstrim job in Cron for each filesystem on the SSD that's not mounted with the discard option. If none of your filesystems use automatic discard, you can just use: `fstrim --all`

This will silently ignore any filesystems that don't support discard,

Getting Linux and SSDs to play nice isn't too tricky.



so it won't matter if you have a USB drive plugged in when it runs. If you add the -v option, fstrim reports what it has done, which would be mailed to you if MAILTO is set in your crontab.

APC staff

WINDOWS

WHY BOTHER PATCHING?

My dad still has a PC running Windows XP. It has SP3 and was fully patched up to the point where Microsoft stopped supporting XP. He insists that this is perfectly good enough for what he wants (online shopping, email, plus a few very old games). I have tried telling him that he has basically left his front door wide open but he thinks I'm exaggerating. How can I convince him?
Liam Jefferies

He's not necessarily wrong. Windows XP has twice as many known vulnerabilities and exploits as Windows 7 (and most of Win7's vulnerabilities only apply to Windows phones), but on a fully patched system, he's really only vulnerable to new exploits. As long as your dad has a modern broadband router, with a built-in hardware firewall, and he never installs new software or clicks ads on web sites, he'll probably be fairly safe from harm.

Sure, it's possible that someone could mount a drive-by attack via Wi-Fi, but it's more like leaving your back door unlocked than the front door wide open. The risk depends a lot on the area you live in. Personally, I keep my virtual doors and windows shut tight at all times, but my physical back door is almost never locked.

That's not to say your dad shouldn't upgrade though, just that security is the wrong stick to beat him with. What I tell my dad is that if he wants tech support from me, he has to always stay no more than one version of Windows behind me. That seems to work.

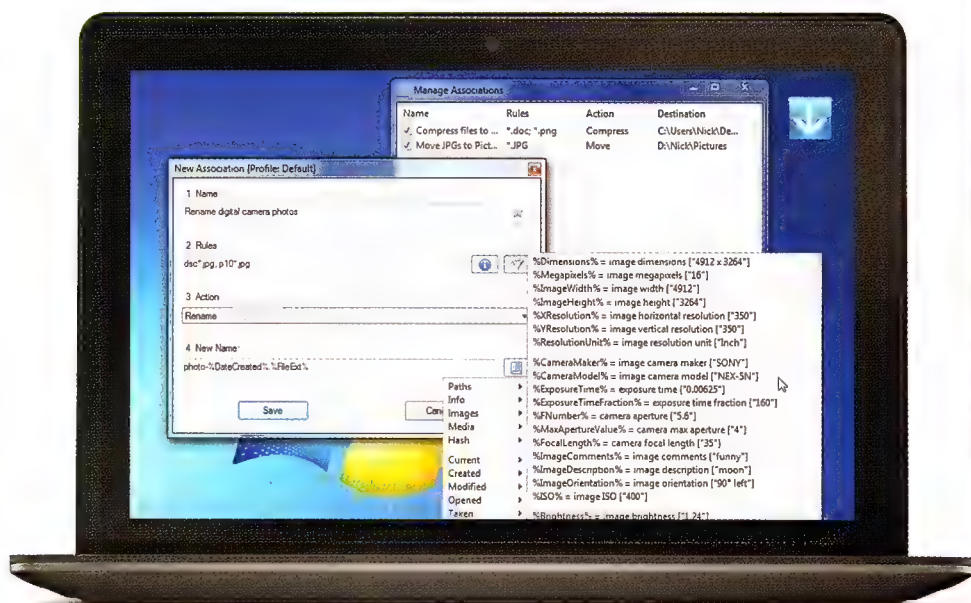
Luis Villazon

Better Windows file management

Nick Peers takes the stress out of file management by letting DroptIt organise and process selected files and folders speedily, simply and automatically.

DroptIt is a tiny free tool that's designed to speed up common file and folder operations such as copying, moving, renaming and encrypting. You can set it up to monitor selected folders automatically, or manually drag files and folders on to the DroptIt icon, which floats above all other windows on the desktop.

DroptIt uses a series of associations to select files, filtering them by name, type or even properties. It then performs a specific action on the selected files, which you can customise to suit your personal needs. You can set up multiple associations covering a wide range of files and types, and even organise your associations into profiles for specific tasks. If you regularly find yourself performing the same file-based tasks over and over again, you're going to love DroptIt.

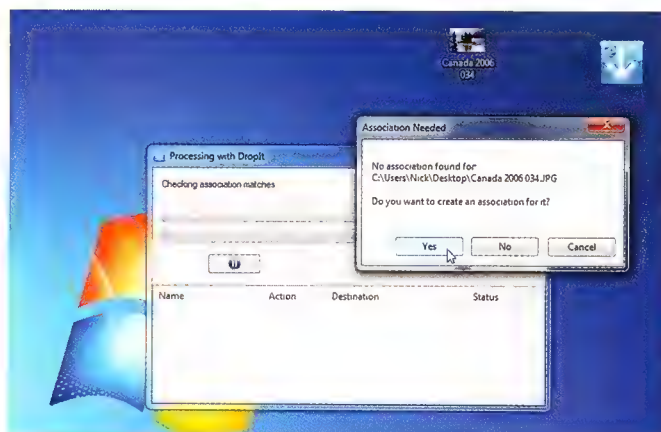


Get started with DroptIt



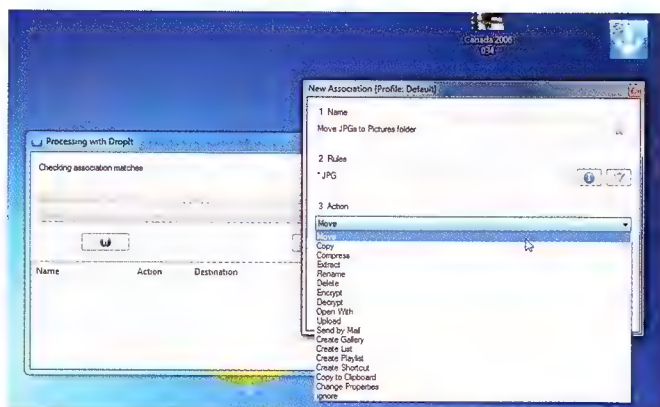
1 SET UP DROPTIT

Download and run the portable version from www.droptitproject.com. If installing, tick 'Launch DroptIt' at the end of the setup before clicking Finish. You'll see an arrow appear on-screen — this is the DroptIt tool, which floats on-screen above other windows. Click on it and drag it somewhere less distracting — a right-hand corner, for example.



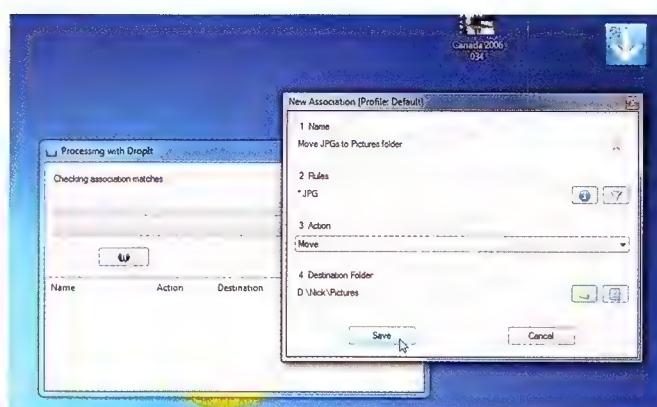
2 YOUR FIRST ASSOCIATION

DroptIt works by creating associations that process files based on a set of rules. For our first example we're going to create a simple association that moves any JPG file dragged on to the DroptIt icon to your Pictures folder. First, locate a JPG file and drag it on to the DroptIt icon. Click Yes when prompted, then give it a suitably descriptive name to help you identify it.



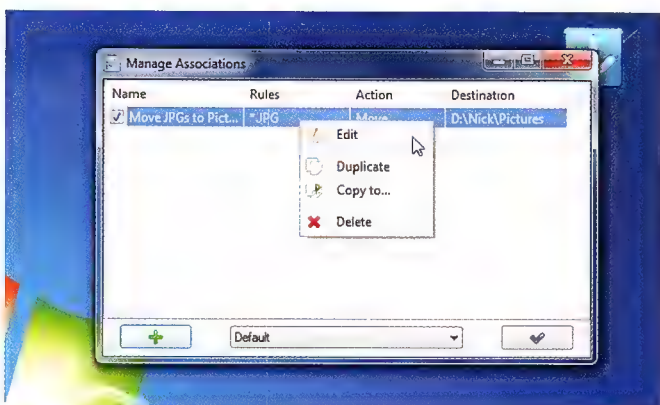
3 VERIFY RULES AND ACTION

You will notice that the Rules box is already pre-filled with *.JPG, indicating that the association will only apply to files whose names end in .JPG. Click the Action drop-down menu to see a list of all 18 actions you can perform using the program. As this rule is designed to simply move all JPG files that are dragged on to the Dropt icon to your Pictures folder, leave Move selected for now.



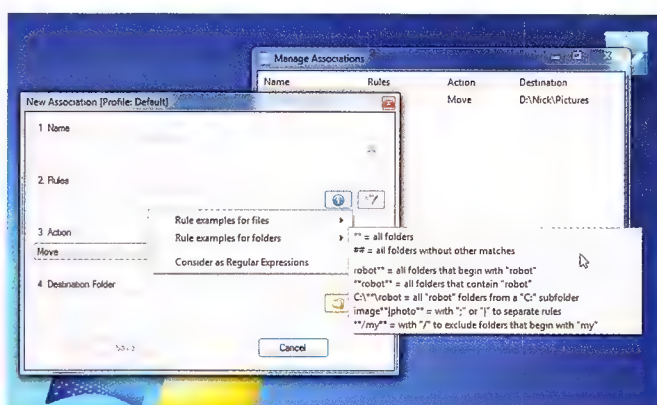
4 COMPLETE ACTION

Click the folder button next to Destination Folder to select your Pictures folder (if you try to select your Pictures library, Dropt will simply create a Pictures folder on the desktop for your files), then click Save. You'll notice that the association isn't performed immediately — instead, click the Play button and the file will be magically moved. Test it with another JPG file.



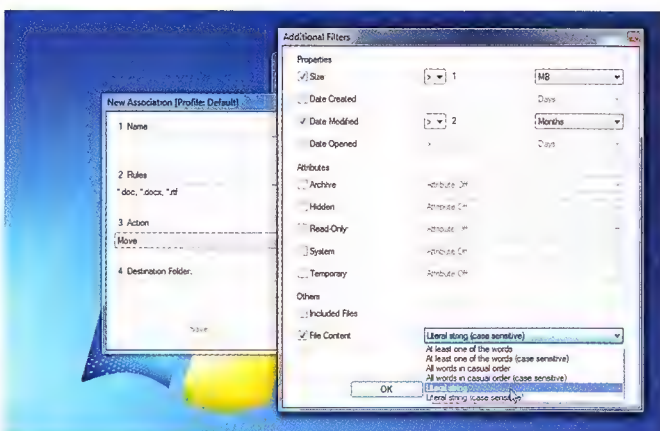
5 CREATE SECOND ASSOCIATION

Right-click the Dropt icon and select Associations to manage existing associations and create new ones from scratch. You'll also see a Default drop-down menu. Clicking this reveals that Dropt supports profiles, allowing you to organise and switch available associations depending on specific circumstances. We'll cover those later — for now, click '+' to create another association.



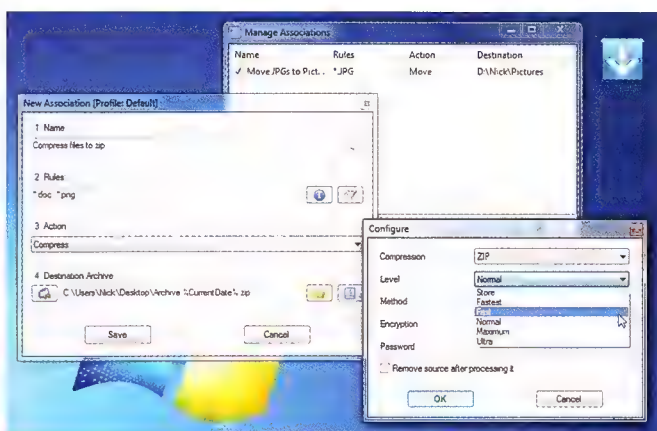
6 APPLY MORE COMPLEX RULES

Each rule uses a set of filters to determine which files or folders to process. Click the 'i' button next to the box to see examples of filters you can create based on the file or folder name. Use the * character as a wildcard for files, and ** characters for folders. Use the / character to exclude items. To apply multiple filters, separate each one with either a semi-colon or | character.



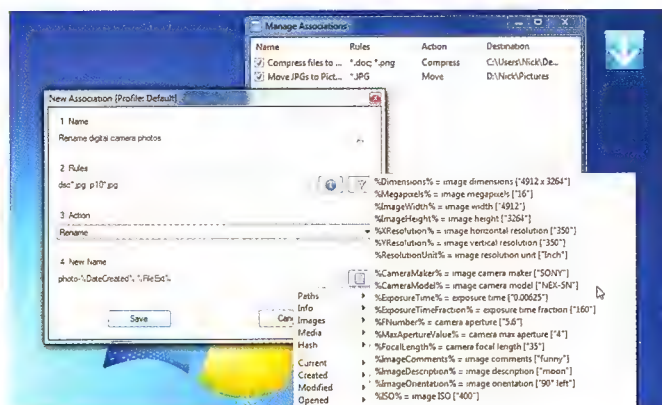
7 MORE FILTER OPTIONS

You can also apply filters based on file properties, attributes and even file content. Click the funnel button next to the 'i' button to choose these. Tick a filter to enable it, then click the > drop-down menu to make the filter apply when the file is greater than (>), equal to (=) or less than (<) the given attribute. File content lets you match based on words or text strings.



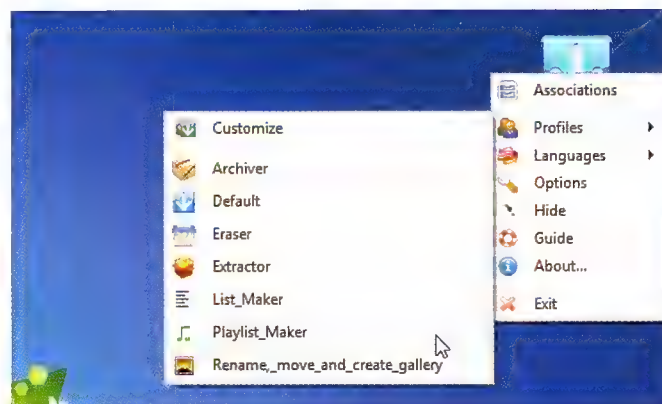
8 ACTIONS: COMPRESS

Click the Action box to reveal different actions you can perform on a file — one action can be performed per association. Use Compress to pack together all the files selected by the filter into a single archive file, for example. Note how the final box changes depending on what option you select — for compressed files, click Configure to choose an archive type, for example.



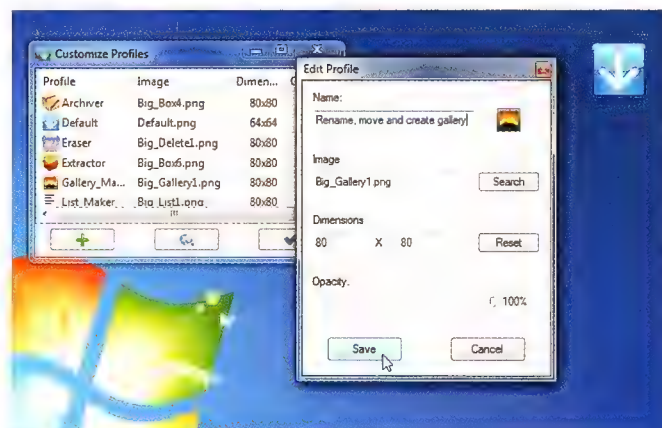
9 ACTIONS: RENAME

The Rename option is good for quickly renaming digital camera photos that have unhelpful filenames, like GEDC0500.jpg. After selecting Rename, click the book icon next to the file name to reveal a list of options that can be inserted into the renamed filename. Select Images to see a list of naming options including file dimensions and the date when the photo was taken.



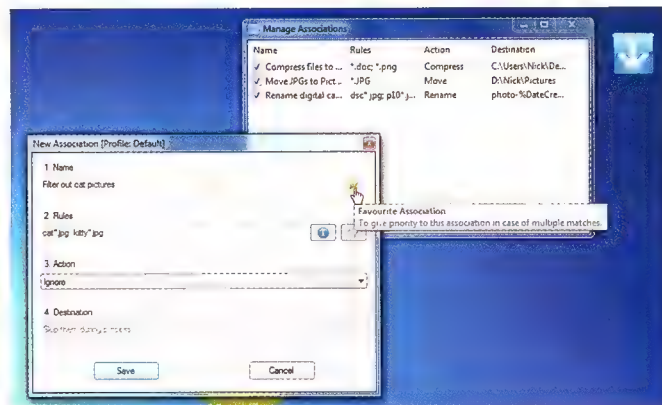
11 USE PROFILES

Dropt supports profiles — collections of related associations that can be applied for specific purposes. The program includes a number of profiles with pre-built associations for a variety of uses, including creating music playlists and compiling text lists of files. To switch profiles, right-click the Dropt icon and select your profile from the Profiles drop-down menu.



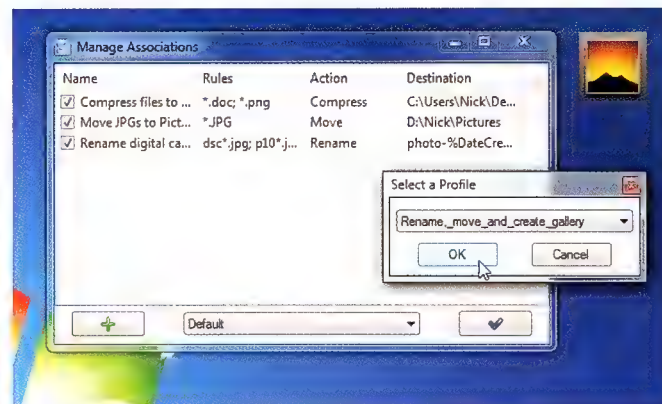
13 MANAGE PROFILES

To set up and manage profiles, right-click the Dropt icon and choose 'Profiles > Customize'. Click '+' to create a new one. Give it a suitable name, then click the Search button to pick the icon Dropt will use when the profile is selected. Alter its dimensions to change its size and use the Opacity slider to adjust transparency, if required. Click Save when you're done.



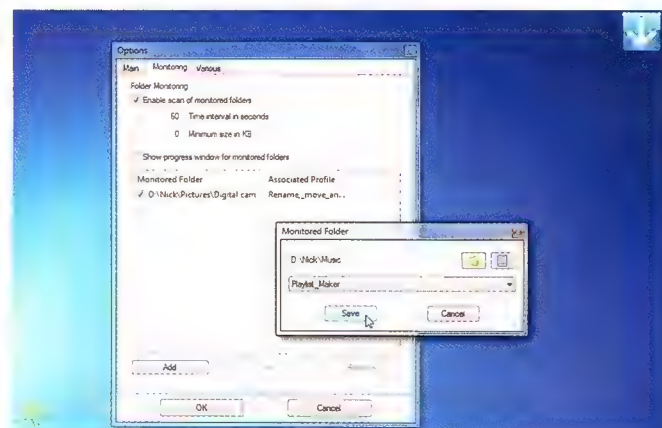
10 MORE ACTIONS

Other handy actions include creating image galleries, music playlists and shortcuts, changing a file's properties, or even ignoring it altogether. The latter option is best used for creating exclusion filters, so files matching the rule are immune to any other associations you've set up. To make this work, click the star button next to its name to prioritise it over other associations.



12 VIEW PROFILE ASSOCIATIONS

You'll see the Dropt icon change to the profile icon that's been selected to help identify which one you're using. To see what associations this profile performs, right-click the icon and choose Associations. You can transfer any of these to another profile: right-click one and select 'Copy' to do so. Select another profile from the drop-down menu to view its associations.



14 MONITOR FOLDERS

To have Dropt monitor folders automatically, right-click the Dropt icon and choose 'Options > Monitoring'. Tick 'Enable scan of monitored folders', then click Add to choose a folder using the folder button. Select the profile whose associations you want to process on any files in the selected folder and click Save. Repeat for any additional folders you wish to monitor.

Conditional formats for Excel charts

Helen Bradley shows you how to apply conditional formats to an Excel chart using VBA.

One feature missing from Excel is the ability to apply conditional formatting to a chart. So, for example, to colour the bars in a chart based on the values they represent can only be done using VBA.

BUILD A SOLUTION

To see such a VBA solution at work create a column chart based on a single range of data. We've used some fictitious maximum monthly temperatures and our data range is A1:M2. Select the data and create a column chart from it.

EXPLORE THE PROBLEM

Colouring a bar or column in a chart is easy to do using the Chart.SeriesCollection(1).Points(1).Format.Fill.ForeColor.RGB property. However, finding the value being plotted on that bar or point is more difficult. You have two viable options – one is to get the value from the cell which contains the data being plotted and the second is to get the value from the point's data label – this is the method we will use.

To access the data label you need to add data labels to your chart. If desired, you can place them at the Outside End and set the text colour to match the chart background so they are invisible. As data labels show the value being plotted we can use this value to conditionally format the chart.

Another problem is to ensure that the chart's formatting updates if the data it is based on is changed. To do this we will need to trigger the macro to run when any of the cells containing the plotted data are changed.

This can be done by adding the macro to the sheet code and using the worksheet_change event handler to run the macro.

This code will trigger the macro to run when a cell in the range B2:M2 is changed:

```
Private Sub Worksheet_Change(ByVal Target As Range)
    Dim chartDataCells As Range
    Set chartDataCells = Range("B2:M2")
    If Not Application.Intersect(chartDataCells, Range(Target.Address)) Is Nothing Then
        updateChartColors
    End If
    Cells(3, 3).Select
End Sub
```

This macro will colour the points in the chart based on their value:

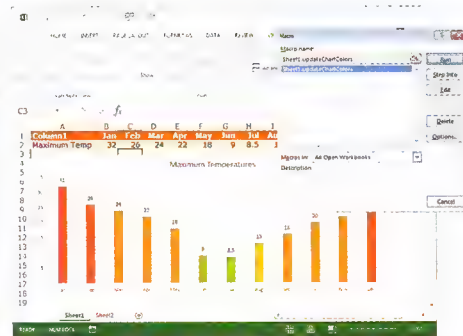
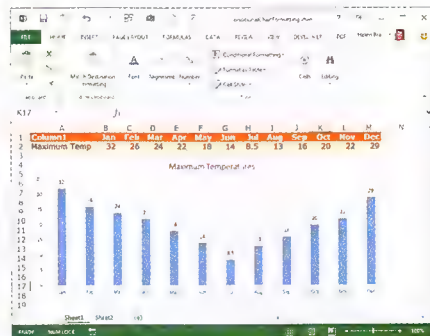
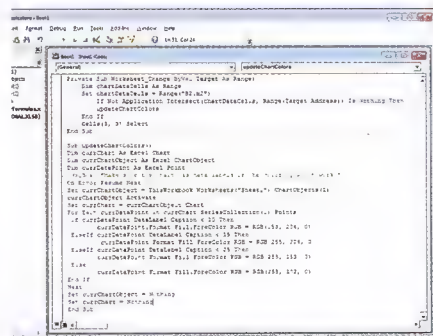
```
Sub updateChartColors()
    Dim currChart As Excel.Chart
    Dim currChartObject As Excel.ChartObject
    Dim currDataPoint As Excel.Point
    MsgBox ("Make sure the chart has data labels or the
```

Get it

Download the sketch you need for this article from www.apcmag.com/magstuff.htm

coloring won't work!")

```
On Error Resume Next
Set currChartObject = ThisWorkbook.Worksheets("Sheet1").ChartObjects(1)
currChartObject.Activate
Set currChart = currChartObject.Chart
For Each currDataPoint In currChart.SeriesCollection(1).Points
    If currDataPoint.DataLabel.Caption < 10 Then
        currDataPoint.Format.Fill.ForeColor.RGB = RGB(153, 204, 0)
    ElseIf currDataPoint.DataLabel.Caption < 15 Then
        currDataPoint.Format.Fill.ForeColor.RGB = RGB(255, 204, 0)
    ElseIf currDataPoint.DataLabel.Caption < 25 Then
        currDataPoint.Format.Fill.ForeColor.RGB = RGB(255, 153, 0)
    Else
        currDataPoint.Format.Fill.ForeColor.RGB = RGB(255, 102, 0)
    End If
Next
Set currChartObject = Nothing
Set currChart = Nothing
End Sub
```



1 ADD THE MACRO

To add the macro to the workbook, right click the sheet tab and choose View Code. Type the code into the code area for this sheet in the workbook.

2 ENABLED MACRO

Return to the worksheet and ensure you have added data labels to the chart (even if they are invisible) and save the workbook as an XLSM macro enabled file.

3 RUN THE CODE

Run the macro using the 'View > Macros' command on the ribbon. You can also run it by changing the value in any cell in the range B2:M2.



Run Windows apps on Linux

Jonni Bidwell sees double as he harnesses the heady power of Wine to tap into Windows software.

When Omar Khayyám decreed that Paradise was to be found "Here with a loaf of Bread beneath the bough, A Flask of Wine, a Book of Verse — and Thou Beside me singing in the Wilderness..." it's unlikely that he had cross operating system shenanigans in mind. Be that as it may, if he were alive today, he would surely find comfort in

these verses. You too could be spared the indignity of having to select that Other OS from your computer's boot menu and, who knows, maybe even attain that little satori that comes with removing it altogether.

Wine (Wine Isn't An Emulator) provides a compatibility layer by which Windows API and function calls are translated into Linux ones.

This is not a perfect process, nor even a complete one, and with so many great open source titles out there it's hard to overstate the benefits of finding a native alternative. That notwithstanding, there are some situations in which Windows applications cannot be avoided, and it's nice to be able to use them without a reboot or journey into a virtual machine.

Wine will almost certainly exist in your distribution's repositories, if you want the absolute latest version then you can always get the source from winehq.org and compile it yourself, or use the PPA on Ubuntu. Possibly the first thing you'll notice is the Wine smash on your file associations: images and HTML files will want to open in Wine Internet Explorer, and text documents in Wine Notepad. At this point you could be forgiven for stopping reading, but apart from this minor indiscretion Wine is generally a well-behaved creature. Mercifully, the Wine FAQ provides the following commands for undoing the aforementioned atrocity:

```
# rm -f ~/.local/share/mime/packages/x-wine*
# rm -f ~/.local/share/applications/wine-extension*
# rm -f ~/.local/share/icons/hicolor/*/application-x-wine-extension*
# rm -f ~/.local/share/mime/application/x-wine-extension*
```

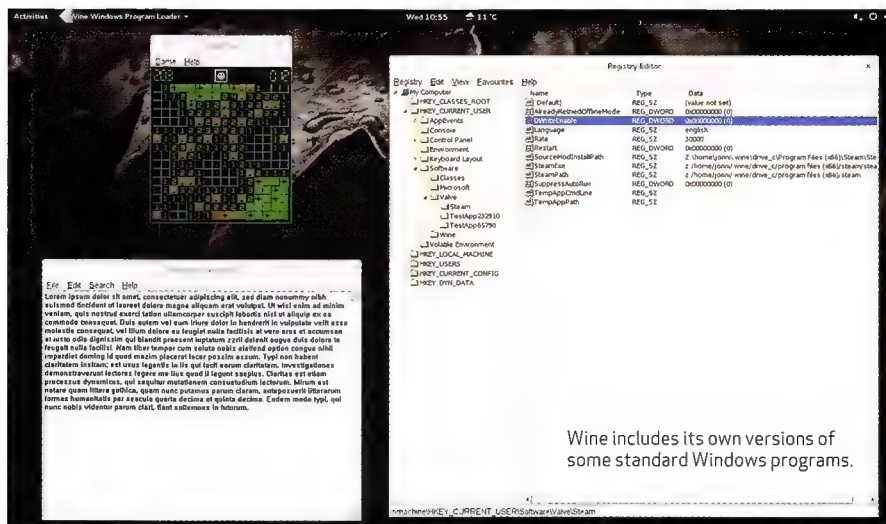
CHROOTY SCHROOTY

If you have a 64-bit OS then the Wine package will install a bunch of 32-bit libraries in order to run 32-bit Windows programs (on Arch Linux this requires enabling the multilib repository, and Debian requires you to `dpkg --add-architecture i386`). Some people prefer not to have a multilib/multiarch system (and some people just like to make life more difficult), so an alternative solution is to set up a 32-bit chroot environment and install Wine therein. A chroot environment is a jailed Linux OS (or part thereof) that lives in a directory in an external Linux. The chroot uses the host's kernel, pseudo-file systems (`/dev`, `/proc`, `/sys`) and any required config files from `/etc` in order to function. Once the environment is set up, you change the apparent root directory (`/`) to that of the chroot, hence the name.

The procedure for setting up the chroot depends a great deal on which distribution or programs you want to install: for a Debian (or Debian-based) chroot the `debootstrap` utility does all the heavy lifting and for Fedora there is `fedbootstrap`. For other distributions, the procedure varies. It's important to note that although you are under no obligation to match chroot environment with host, if you don't you'll run into all kinds of difficulties with differing OS layouts and driver library versions.

For our purposes, let's say you're running Ubuntu 14.04 and want to set up a 32-bit chroot at `/opt/ubuntu32`:

```
# debootstrap --arch=i386
```



Wine includes its own versions of some standard Windows programs.

Winetricks

If (when!) you run into difficulties with a particular application, look for it on appdb.winehq.org and you'll probably find some guidance. Sooner or later you'll find mention of Winetricks, a helper script that automates the task of installing commonly required gubbins, such as applications, runtime libraries (including various incarnations of DirectX) and fonts (yay Comic Sans). Some distributions include the winetricks script as part of their Wine package, but if not you can download it and make it executable thusly:

```
wget http://winetricks.org/wine
chmod +x winetricks
```

Winetricks will take care of any

necessary dll overrides and registry changes, but do bear in mind that this might break things subsequently installed into the same prefix. It's therefore prudent to run things, if possible, inside a clean Wine prefix. Conversely, you could also do any winetricks voodoo in a dirty prefix, eg. to install DirectX 9 (which you shouldn't need to do, but exceptions abound):

```
# WINEPREFIX=~/.wine-dirty
winetricks dx9
```

Many applications require the Microsoft core fonts to be installed, which you can do with:

```
# winetricks corefonts
```

though it does require the `cabextract` program for extracting from Microsoft's cabinet format.

```
--variant=buildd trusty /opt/
ubuntu32/ http://uk.archive.
ubuntu.com/ubuntu/
```

The schroot program provides a handy means of managing chroot environments, it's available in all good repositories. Schroot will, if you set `type=directory`, bind the host's users and groups, as well as the filesystems mentioned earlier. Furthermore, this option will also mount `myuser`'s home directory inside the chroot, which can be confusing. Once installed add a profile to `/etc/schroot/schroot.conf`, replacing `myuser` with your username:

```
[trusty32]
description=Ubuntu Trusty
location=/opt/ubuntu32
users=myuser
personality=linux32
type=directory
```

Now chroot into your new environment, check it has the desired cardinality of bits and update the package lists with a simple:

```
# schroot -p -c trusty32
# uname -m
i686
# sudo apt-get update
```

The `-p` option imports all your environment variables, such as `$DISPLAY`, which will help graphical programs work. If the second command returns `x86_64` then something wrong happened.

LXC containers are new-fangled alternative to chroot environments, and they offer a greater degree of isolation thanks to new kernel features, such as `cgroups` and `namespaces`. It is these animals that form the basis of the exciting new

Docker virtualisation, so they're well worth having a look at (though sadly beyond the scope of this article).

WINE BOTTLES

Wine will set up a virtual windows directory (aka Wine Prefix or Wine Bottle) at `~/wine`. Inside you will find a `drive_c/` folder with the familiar(?) Program Files and Windows directory layout. You will also find a symlink, which enables your root filesystem to be accessed as drive z: from your Windows applications. The general consensus is that Wine's WoW64 (the subsystem that allows 32-bit binaries to run on a 64-bit installation) implementation is now fully operational, but if you do run into problems on a 64-bit system you can set up a 32-bit prefix:

```
# WINEARCH=win32
WINEPREFIX=~/wine32 winecfg
```

and then run any problematic programs (such as `prog.exe`, for example) with:

```
WINEPREFIX=~/wine32 wine prog.exe
```

You can do some basic configurations with the `winecfg` utility, including

choosing your favourite(?) Windows version, mapping other paths to Windows drives and enabling a virtual desktop. Perhaps the most important tab here is Libraries, in which you can choose to use the native Windows DLL libraries as opposed to their built-in Wine equivalents. You can use `winecfg` to configure on a per-application basis, which is handy.

Controversially, Wine stores all of its settings in the registry (which you can access with wine `regedit`) at the key `HKEYCURRENTUSER\Software\Wine`. There's a lot to fiddle with here but chances are none of it will solve any problems. For example, you could turn off GLSL by adding the string:

```
HKCU\Software\Wine\Direct3D\
UseGLSL
```

and setting it to disabled. You might get a chortle from the warning message that results when you try and run anything with this setting. It's more likely that various Windows programs will need tweaks in their own registry keys. For example, people often find that running the Steam client results in no text being drawn. One solution is to preclude Steam's use of DirectWrite by adding the `DWORD` key `DWriteEnable`

with value 0 to `HKCU\Software\Valve\Steam`. You can do this from the command prompt if `regedit` makes you feel dirty:

```
# wine reg add 'HKCU\
Software\Valve\Steam' /v
DWriteEnable /t REG_DWORD /d
00000000
```

This provides a seamless segue into the next section.

STEAMY WINDOWS

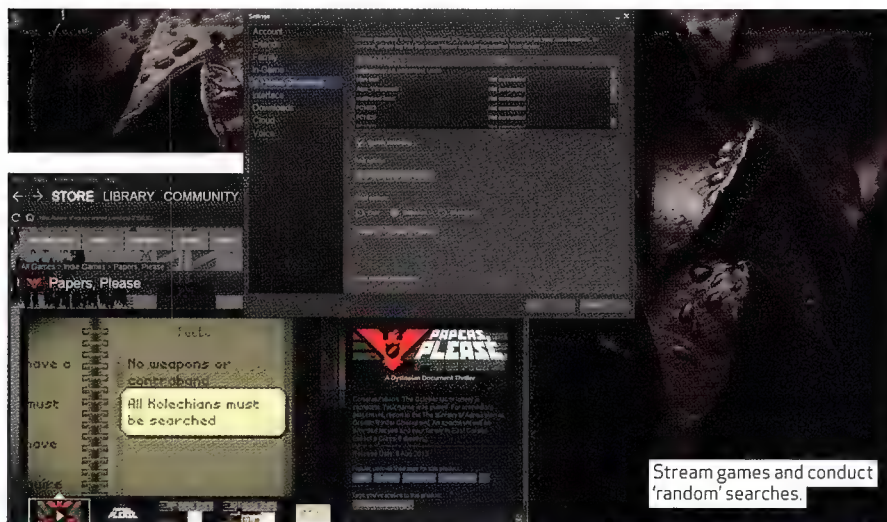
Actually Windows-ey Steam is more accurate, but Tina Turner never sang that. You can install Steam by following the install link on store.steampowered.com and selecting the Windows option. Then run the `SteamSetup.exe` file with `# wine SteamSetup.exe`.

This will give you a menu icon for the Steam client. You will probably want to install corefonts and disable `DWrite` per the procedures explained above. Some games will ungraciously exit as soon as keyboard input happens. This unfortunate bug is due to Wine having issues with the In-Game Overlay used for chatting with your Steam friends, so the solution is to disable that in 'Steam Settings > In-Game'. You can also disable this per-game by right clicking the problematic game in the Library tab, and selecting Properties.

Another gripe that you might run into is games complaining about lack of texture-compression support. This is due to default Mesa (the open source OpenGL implementation) installations not including full support for the patented S3TC texture compression algorithm family. You can work around this by setting the environment variable `force_s3tc_enable=1`, which exposes the partially-implemented, legally sound extension, though that may misbehave. Alternatively you could install the legally dubious, open source `libtxc_dxtn`, which provides a full implementation.

Yet another mysterious issue you might run into is the error 'Failed to start game (missing executable)'. You can execute such troublemakers directly (see what I did there) by going into the `SteamApps/common` subdirectory of your Steam installation and finding the desired targets. Various (non-Wine specific) solutions are offered on the forums, all of which seem to be concerned with manipulating `.acf` (application cache) files, but it seems like on Wine there is some quirk with games with special characters (typically spaces) in their path.

At the time of writing it seems like the closed-source Nvidia driver is far more suited to gaming than Nouveau, its open source counterpart. The main obstacle here is the lack of support for



PlayOnLinux

Though the concept of making things easy brings a shiver to our collective spines, we will take a moment to mention a tool that does precisely this. Don't worry, we shall ensure all this can't remain strictly within the confines of this box. PlayOnLinux is a front-end for Wine which provides a categorised repository of packages, which provide a scripted install for all manner of applications. An application's script takes care of any

Wine-related exigencies and it's relatively straightforward to write and contribute your own. Each application is installed in its own prefix and you can even specify different Wine versions per-application.

The initial setup of PoL demands that you install the Microsoft fonts, but once you consent to this everything is (in theory) only a few clicks away. Read more at www.playonlinux.com — it's time to return to complicated stuff.

changing GPU and memory clocks. Hopefully this situation will change in the future, Nvidia has released some specs for various chips (most recently its Tegra K1 SoC) and even received a Torvalds-ian thumbs up for doing so. So maybe we're moving on from the F-bombs and middle fingers of days passed... In the AMD camp the divide is not so clear cut, the open source driver really gives Catalyst a run for its money.

You can even get Valve's In-Home Streaming working in Wine, so that you can stream titles which run on Wine over your network to lower-powered machines running the Linux Steam client. This means you only have one Wine installation to worry about, and can have all your games stored on a powerful, noisy machine under the stairs. Such a machine (commonly referred to as a Steambox) wouldn't need such frivolities as peripherals and a monitor, so assuming it is running ssh:

```
# ssh -X steambox
# winecfg # Set windows
version to 7
# cd ~/.wine/drive_c/Program\
Files\ \(\x&b\)/Steam
# LIBGL_ALWAYS_INDIRECT=1
wine Steam.exe
```

This will give you a very laggy Steam client (it's passing all the OpenGL commands over SSH) running over the network from which you can navigate to 'Steam > Settings > In-Home-Streaming' and check 'Enable streaming'. Once this is selected you don't want to have it clogging up your pipes with its window data, so run it in this manner thereafter:

```
# ssh steambox
# cd ~/.wine/drive_c/Program\
Files\ \(\x&b\)/Steam
# DISPLAY=:0.0 wine Steam.exe
```

The Linux Steam clients will automagically see steambox and its library, and you will see a 'Stream' option, which will do the business. You might need to tweak the streaming settings depending on your network, but Powerline or Ethernet connectivity should be able to take the strain.

Besides gaming, a popular use case for Wine is to watch Netflix, or indeed any other form of DRM-encumbered streaming content. Netflix and other such services rely on Microsoft's Silverlight plugin to display and protect their content, and Silverlight is only available for Windows and Mac. We shall rely on the Pipelight plugin to circumvent this requirement. Pipelight uses a patched version of Wine in order to run Windows plugins in the Linux web browser of your choosing. If you are on Gentoo then you can (for versions of Wine since 1.7.19) just add the pipelight USE flag to app-emulation/wine to



install it, for other distros check the extensive guide on the FDS-Team web site: pipelight.net/cms/installation.html. Once installed, you can enable the Silverlight (and optionally flash) plugins with:

```
# pipelight-plugin --enable
Silverlight
```

You will be prompted to accept two licenses, by pressing Y, and asked to optionally accept the conditions for the debug version of wininet.dll by making a file as follows:

```
touch $HOME/.config/wine-
wininet-installer-accept-
license
```

Some people report that the older Silverlight 5.0 does a better job for some services. You can enable this like so:

```
# pipelight-plugin -disable
silverlight5.1
# pipelight-plugin --enable
silverlight5.0
```

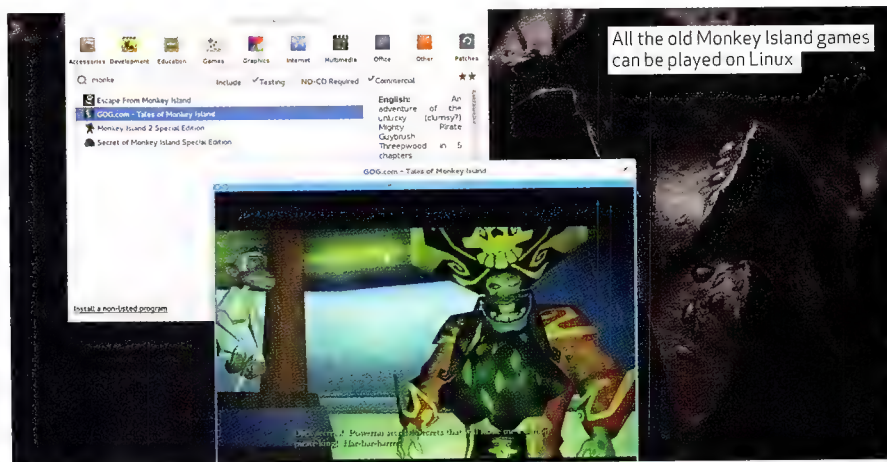
Be aware, though, that there are probably (more) security issues with this older version.

In addition to Pipelight, you will likely need a user agent switcher for

your web browser, since Silverlight and many web sites that employ it won't work with a browser that is honest about being run on Linux.

Besides these leisurely pursuits, another scenario where one could conceive Wine to be used is running industry-mandated applications, such as Microsoft Office or Adobe Creative Suite. Unfortunately these are not particularly Wine-friendly: According to the Wine Application Database, the 32-bit version of Microsoft Office 2010 works, but not so Office 2013. Likewise older versions of Photoshop (CS4) and InDesign (CS2) have been reported to work, but the new Creative Cloud is much less compliant.

Things are no better on the commercial package CrossOver Linux (based on Wine), although this does provide support for many other things not currently working on Wine. You can use Microsoft's web apps for free, which is fine if you just have to fiddle with the odd, complicated .docx file format, but this rapidly gets old if you have to do it every day. In sum, if you really want these behemoth applications working in Linux, you'll have to use a virtual machine. ■





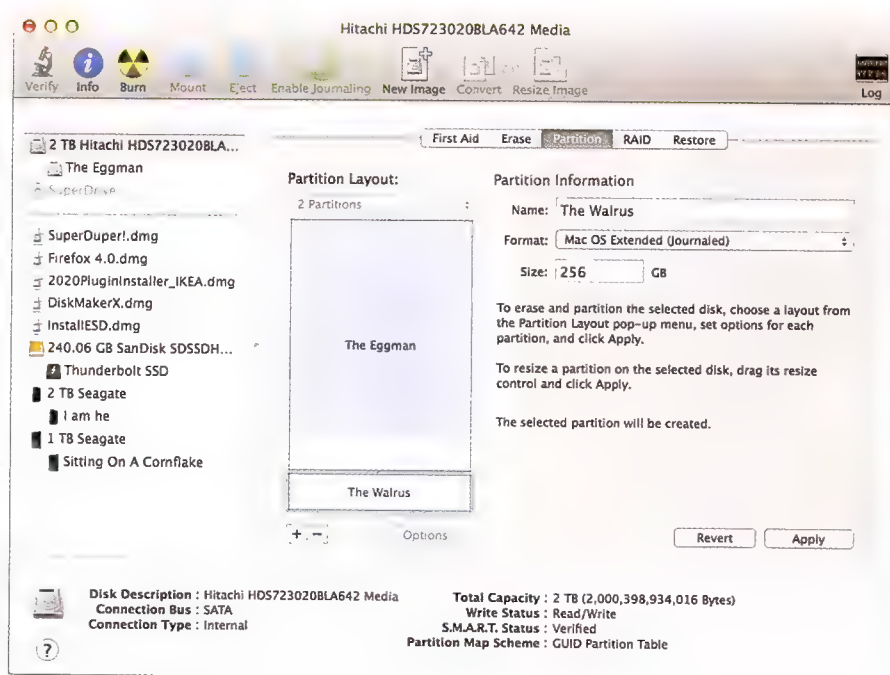
How to get your hands on Yosemite early

OS X 10.10 — Yosemite — will be available before the end of the year. If you can't wait until then to try it out, Matthew JC. Powell is here to show you how.

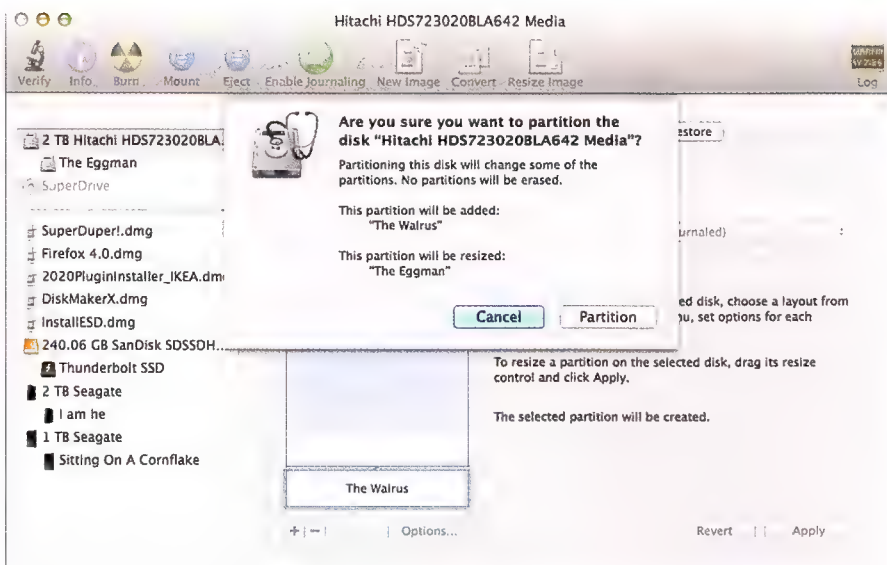
Apple unveiled some of the new features of OS X Yosemite at its Worldwide Developer Conference (WWDC) in June to much excitement, then disappointed millions of Mac enthusiasts by proffering a release date of Spring. Given the vagueness of the date, not to mention its complete lack of right-nowness, more than a few people are a bit impatient.

The good news is that you no longer have to be a paid-up member of Apple's Developer Connection to get your hands on the new OS. Up until now advance access to OS updates could be had for a fee, but with Yosemite there's a free public beta.

Before you go grabbing it, there are of course a few caveats. For one thing, Apple's made it pretty clear that the public beta and the developer releases of Yosemite are going to be different — developers know what they're getting into, and they're more or less equipped to deal with unstable and unfinished code. The public betas will likely be



Once you've backed everything up, run Disk Utility, and define the partitions you want. Don't forget to leave yourself some space.



Are you sure? Before you do anything permanent, you'll be advised what's about to happen. Since nothing's going to be erased, all looks good to proceed.

Total Capacity : 2 TB (2,000,398,934,016 Bytes)
Write Status : Read/Write
S.M.A.R.T. Status : Verified
Partition Map Scheme : GUID Partition Table

The incredible shrinking partition. You used to have to erase a partition to resize it. Now you can shrink it non-destructively.



Capacity : 2 TB (2,000,398,934,016 Bytes)
Status : Read/Write
Status : Verified
Scheme : GUID Partition Table

more stable, but will also lack some of the "sneak peek" aspects of the developer releases.

Whether you get developer releases or the public betas, you're getting unfinished software and it is more than likely going to be somewhat buggy. The developer releases of previous versions of OS X certainly were. It is, therefore, extremely advisable that you not install the pre-release OS on your main productivity machine. Keep your nice, stable Mavericks install intact and install Yosemite on a separate volume.

For that separate volume, you have two choices: either an external drive or a separate partition on your internal drive. If you have a separate drive use that because it's easier.

Important note: if you presently use Boot Camp, and have a partition on your drive formatted to run Microsoft Windows, it is a very bad idea to use Disk Utility to create additional partitions. If you are a Boot Camp user, a separate drive is your only option.

If you don't have an external drive handy, and you don't use Boot Camp, read on.

NON-DESTRUCTIVE PARTITIONING

Once upon a time, in order to divide your hard drive into multiple partitions in OS

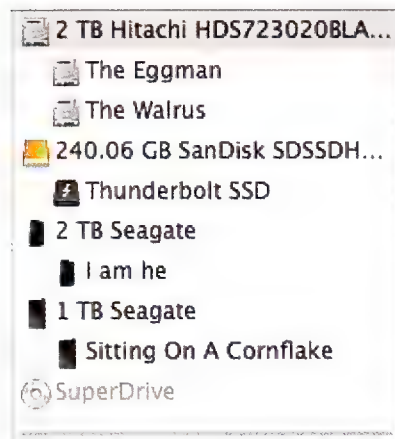
X, you had to erase the drive — you couldn't resize a partition without rewriting the drive's partition table, which would effectively wipe its contents. There were third-party utilities that could do it, with variable reliability, but the tools included with OS X could not.

Since OS X 10.5, that hasn't been the case. Now, all you need to create a new partition on an existing drive is the included Disk Utility, which you'll find in 'Applications > Utilities'. Be aware, though, that even with the non-destructive functionality, things can go wrong. It's a really good idea to back up your data first, just in case.

Once you launch Disk Utility, you'll see the mounted drive hierarchy in a column on the left-hand side. Your startup drive will be at the very top of the list. Below that, and slightly indented, you'll see the name that you actually gave your drive — this might be "Macintosh HD" if you've never renamed it, otherwise you'll recognise its name.

If you click on a Volume — one of those drives with a name you recognise — you'll see a toolbar with four options: First Aid, Erase, RAID and Restore. If you click on a Disk — the arcane-named thing — you get a fifth option: Partition.

Click on the name of your startup



Post-partitioning. When the whole thing has finished, your new partition will appear in the hierarchy along with the old one. As far as your mac is concerned, it's a separate drive that happens to live on the same disk.

Disk (not Volume) and then on the Partition tab. You'll see your present partition table (in this example, there is only one) with used space shaded in blue. At the bottom of the diagram, there are + and - symbols for adding or removing partitions.

Click on the + symbol, and a second partition will appear in the diagram, occupying all of the free space available. Obviously this is not a good idea — you need to keep some free space on your existing partition.

Use the tabs in the corners of the partitions on the diagram to set partition sizes that make sense to you — enough room to install Yosemite with some free space to install an application or two, while leaving enough free space on the existing partition that it remains useful. You might also want to give your new partition a name at this point, though it's not essential.

Once you have the sizes you want, click Apply. You'll get a message telling you exactly what's about to happen: one partition will be resized, and another created. If that's what you want (and it is), click OK.

After a period of time proportional to the number of existing partitions and the size of your drive, your new partition will mount and be available for use.

NOW TO GET YOSEMITE

The developer release of Yosemite is already available at time of writing, but the public beta hasn't hit quite yet — it probably will by the time you read this. To sign on to the public beta program, go to <http://appleseed.apple.com> and enter your Apple ID. You'll receive an email with a voucher to download the beta from the App Store when it's available. When you run the installer, be sure to point it at your newly-created partition (or external drive) so it doesn't damage your Mavericks install. ■

AirPlay streaming to iOS

Use AirPlay to enjoy your music and videos on other devices.

Your iPad's portability makes it the ideal entertainment device, whether you want to listen to music or enjoy video content on the move. But there will be times when you want to hear your music through a proper set of speakers, watch your movies on your large-screen HDTV, or view your slideshows on compatible digital photo frames. The great thing about the iPad is that you can do all of this — without a single wire in sight...

WIRELESS FOR SOUND

The technology that makes it possible is called AirPlay. This sends audio or video via your Wi-Fi network to compatible speakers or video receivers such as the Apple TV. Depending on your setup, you can even play your music on multiple sets of speakers in multiple rooms. AirPlay is built into your iPad, so you don't need to install any additional apps. You will, however, need a set of speakers or video receiver with the right hardware built in. AirPlay is not the same as Bluetooth, and the two are not interchangeable — you'll need specifically AirPlay-enabled kit to use it.

To get started, your iPad and the receiver need to be connected to the same Wi-Fi network. You can see which your iPad is connected to by tapping the Home button, then tapping 'Settings > Wi-Fi'. Exactly how you connect the receiver to the same Wi-Fi

network varies from device to device; the receiver's instruction manual will guide you through the process.

With both devices connected to the same Wi-Fi network and the receiver switched on, your iPad should detect it automatically. Now all you need to do is start your media playing, swipe upwards from the bottom of the screen to open Control Centre, tap AirPlay and select the receiver you want to play your media on. It's that simple! We'll walk you through the few little niceties on the facing page.

AIRPLAY MIRRORING

As well as streaming audio and video to a receiver device, the iPad can perform what's called AirPlay Mirroring, where the content of the iPad screen is output to a video receiver such as the Apple TV. This means you can browse the web and show others what you're looking at without everyone having to crowd around your iPad.

One of the most exciting uses for this is the ability to mirror games. Depending on how they've been configured, some games enable you to use your iOS device as a controller

Streaming

Apple TV is Apple's \$109 device for connecting an HDTV or speakers to your wireless network — visit tinyurl.com/appletvau for details. If you want to stream or mirror from your iPad to your PC or Mac, though, consider AirServer (US\$14.99) — see www.airserverapp.com for info.

while displaying the action on the big screen via your Apple TV. Others provide extra info on your iOS device's screen — in *Real Racing 2 HD*, for example, there's a map of the circuit and a timer that remain on-screen during the race. *Real Racing 2 HD* and *Sky Gamblers: Air Supremacy* have a split-screen mode, enabling you to play against a friend, using separate iOS devices as controllers. It's the future of gaming! Just find the AirPlay icon in the middle of the Control Centre, click on Apple TV, then switch Mirroring on.

"One of the most exciting uses for this is the ability to mirror games."

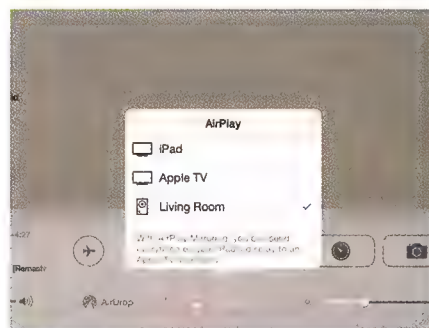
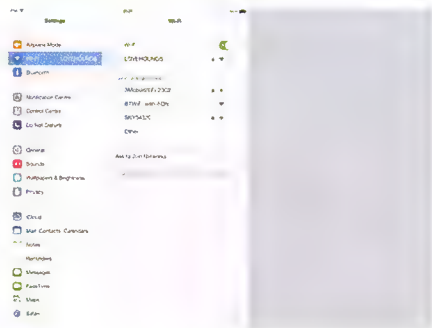


Sound speaker: the AirPlay advantage

The benefits of AirPlay are numerous. Obviously, as you can see from the walkthrough opposite, setting it up is simple. More importantly, you get fantastic audio quality, which is superior to that of audio streamed over Bluetooth because the files aren't compressed. The range is also a great deal better — with Bluetooth technology you need a speaker placed within around 10 metres of the audio source, but with AirPlay the range is as far as your network extends. You can also stream to multiple speakers, which is great if you're having a party and want music pumping throughout the house. And you can even use your iPad as a remote control. When buying a speaker, consider your budget (you can get online deals on older speakers for \$100+, but for a new model with plenty of features, you're looking at \$300+), whether you want the speaker to have a charging dock, and how portable you want the unit to be.

Stream music and video using AirPlay

Bluetooth begone! Set up AirPlay for a better experience.



1 CHECK YOUR WI-FI

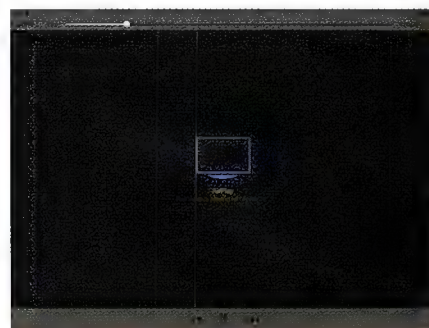
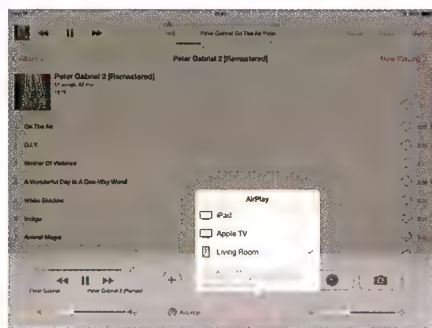
Make sure your iPad is connected to your home Wi-Fi network: look for the Wi-Fi symbol in the top left corner of the screen. If you don't see it, tap 'Settings > Wi-Fi' to find it and connect. Make sure your AirPlay receiver is connected to the same Wi-Fi network.

2 FREE YOUR TUNES

Now tap the Home button, then tap the Music app and tap a song to start it playing. To output it through your AirPlay speakers instead of the iPad's, swipe up from the foot of the screen to open Control Centre, then tap AirPlay in the bottom row of buttons.

3 PICK YOUR SPEAKERS

You'll see all the AirPlay receivers on your network, each with either a speaker or a TV symbol next to it. Simply tap the AirPlay speaker you'd like to use. Your music will seamlessly switch to playing through that speaker. Now swipe Control Centre downwards to close it.

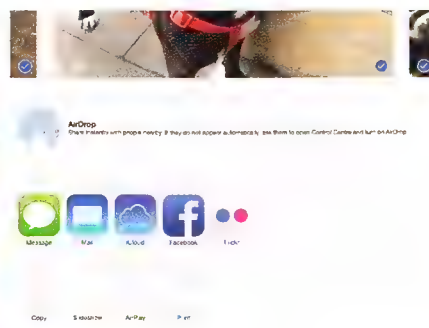


4 CONTROL YOUR MUSIC

With the music coming out of the AirPlay speakers, you can control it directly from your iPad: play, pause, skip or control the volume. To switch AirPlay off, open Control Centre, tap AirPlay again, and pick iPad. This returns the controls to just playing music on your iPad.

5 ENJOY YOUR VIDEOS

The procedure is similar in the Videos app: tap a video you'd like to watch to start it playing. Tap once to reveal playback controls if you don't see them, then the AirPlay icon (bottom right) to reveal the same list of AirPlay receivers that appears in Control Centre.



6 DESTINATION APPLE TV

Tap a receiver with a TV symbol and your video will start playing on it. Your iPad screen will turn grey and specify where the video is being played. You can control the video's playback from the comfort of your iPad with the usual playback controls.



7 STREAM FROM YOUR APPS

You can almost always divert playback to an AirPlay receiver in this way. You can usually open Control Centre even if an app is running in landscape orientation — however, swiping upwards might show only a handle with an arrow on it; swipe again to open Control Centre.

8 SHARING OPTIONS

You'll also find AirPlay among the options available when you tap the Share button in many apps, including Photos. This works in the same straightforward way: tap AirPlay, then tap the video receiver in the list on which you want to display the selected image or images.

Quick tip

AirPlay is so simple to use in iOS 7 that you should rarely have any problems switching output to the device you want. The only thing to watch out for is the difference between receivers capable of video and those capable only of audio. If you do have any problems, most come down to a weak wireless signal. Try to site your speakers closer to your main router if possible, or invest in a wireless range extender (such as an Apple AirPort Express) to relay the signal to the far ends of your home. You can also try moving the router or speaker around for a stronger signal.

Master Steam In-Home Streaming

We've got everything you need to know about Valve's latest revolutionary project.

Game streaming has long been a promise of modern technology, but it's rarely actually been delivered. OnLive and Gaikai, both of which launched a few years ago, wanted to fundamentally alter the way we play and own games by storing them all on a central server and then streaming them to home computers via the internet.

At the time we were a bit miffed by the reality of these strange new services, with bandwidth and lag proving the biggest let downs.

Jargon buster

StdDevFPS

A method of analysing frames per second scores by using standard deviation, which lets you know how widely a set of data is spread out. A low number here indicates a more consistent framerate.

Latency

A catch-all term for stuttering, pauses and drops in quality caused by drops in network or hardware performance. Also known as 'lag' and 'a reason to kick something'.

There was clearly something there, though – these were brilliant, forward-thinking ideas crippled by hardware limitations. OnLive has had a tumultuous few years but it's still with us, just about, while Gaikai has fared far better and become an integral part of Sony's PlayStation 4 home ecosystem. As the technology and bandwidths have matured, Valve has decided it wants a slice of the action too.

Launched as a closed beta earlier this year, Valve's In-Home Streaming system is now available to all users, so you can try it out in your own home. As with all of Valve's products, it works absolutely marvellously and is easy to use; any Steam PCs on your network should automatically see one another and allow streaming of each other's games from their main list. You'll see 'Stream' instead of 'Play' for games located on remote PCs.

KEEPING IT IN-HOUSE

In order to create such a smooth and seamless experience, Valve has omitted Gaikai and OnLive's biggest wildcard: the internet. Because its streaming service is only designed to work in-home, it can take advantage of the solid, speedy networks that connect pieces of domestic technology to one another and the internet.

This also minimises latency, another big problem of streaming interactive media via the internet. Broadband

Top Tips

F8-AL Attraction

Press F8 while you're streaming and Steam will analyse each and every frame, then dump the results in a folder named 'Streaming' in your Steam directory.

connections are great for downloading content, but not so good for uploading. YouTube videos or Spotify songs will buffer themselves so you're not hit with a sudden bandwidth hit. A game, on the other hand, requires a nigh-on instantaneous reaction when you hit a button or move around.

Valve has some experience of this with online gaming, but *Team Fortress 2* and *Left 4 Dead* run almost entirely on the user's computer, with tiny packets of data telling the client who fired that missile, or which zombie just jumped out from where. Streaming a whole game requires this level of interactivity, but it also has to deliver every frame of action at a rate of 30 per second.

Online games are also cleverly built to conceal problems caused by slow computers and slow connections, while streamed games can move at a hell of a pace and feature many more variables. Each and every one of Valve's current

catalogue of thousands of games, complete with their esoteric controls and weird engines, has to work smoothly with the streaming system, which throws yet more spanners into the works.

By keeping things on a local network and in a beta form, Valve has created the perfect testbed to solve these issues while giving gamers an entirely new way to enjoy the most demanding games. And, while Valve hasn't confirmed streaming via the internet, we bet it'll be on the cards once In-Home Streaming is out of beta.

PLATFORM GAMING

In creating In-Home Streaming, Valve has really opened up the possibilities of gaming via your home network. For the first time you're able to play the full range of Steam games on a MacBook, which makes us like those particularly smug laptops a little bit more. It also works with Linux, so you can potentially build a really cheap Steam Machine to connect to your TV and play games on. If you're feeling really adventurous you could even build a 'headless' server PC without a monitor and simply stream games via your home network.

Steam's Android and iOS apps currently don't support In-Home Streaming, but we're expecting this to change in the future, especially if Valve wants to compete with Sony's PlayStation streaming. Nvidia's Shield already does this to a certain extent, but it's locked to Nvidia GPUs, while Valve has been rather more egalitarian by ensuring that almost all hardware works with In-Home Streaming.

Top Tips

Heavy traffic

Under 'Advanced host options' in the In-Home Streaming settings you'll find the option to prioritise network traffic, if you have a compatible router.

At the moment the closest you'll get to a handheld streaming device is a Windows 8 tablet such as Microsoft's Surface Pro, which can be a pretty formidable gaming machine in its own right, especially when paired with an Xbox controller. Playing proper PC games on a touchscreen alone is still a bit of a nightmare though, and we're not sure what Valve can do to overcome this human interface disaster.

In this guide we'll show you the nuts and bolts of getting In-Home Streaming set up yourself. The initial stages are really, really easy, but the process can throw up problems so we'll explain how to look at Steam's numerous and often mind-boggling stats and use its diagnostic tools so you can improve your connectivity and make the most of your hardware.

We've even found a cheeky way to stream games over the internet, and a method to access your Windows desktop via Steam, although these aren't official features of the In-Home Streaming beta. Once you've got it set up, you'll never look back – and you'll finally be able to live the 2007 dream of playing *Crysis* on a netbook.

Hardware requirements

The complexities of streaming HD games may conjure images of a great big supercomputer in your living room, but our source PC is actually a surprisingly modest machine. It features an ageing Intel Core i7 860 processor, a measly 8GB of RAM and a coal-powered Radeon HD 5870 card, yet it's able to muster enough grunt to stream *Thief*, *Metro: Last Light* and *Dota 2* at HD 720p resolution.

At the other end of the setup, the system requirements are even lower. The most important component is a graphics chip which supports H264 decoding, which is pretty much all of them. We streamed *Batman: Arkham Origins* onto a five-year-old Sony Vaio laptop, and although it sometimes stuttered in places, the overall experience was smooth and impressive.

Of equal importance to your hardware is your home network. A completely wired setup is preferable, but we found powerline adapters offered a negligible dip in performance. If you're afraid of wires for some reason, N and AC Wi-Fi networking play nicely with In-Home Streaming. However, we have found that despite its Ethernet-like speeds AC networking doesn't quite have the range of N.



ON SALE NOW

Grab the print or digital edition of our September issue now!



In-depth analysis

Problems with your stream? Use Steam's tools to fix them.



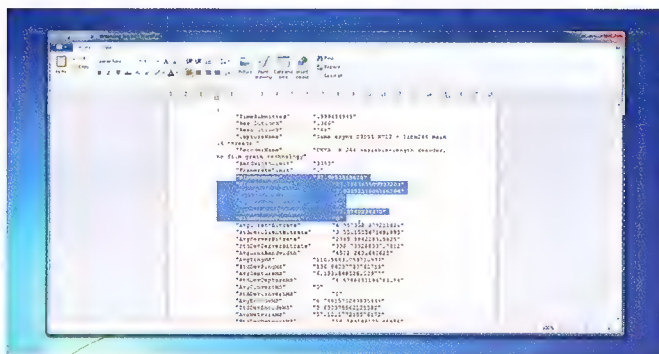
1 SWITCHED ON

You'll find the option to switch on Steam's streaming analysis tools in the 'In-Home Streaming' section of Steam's settings on your client PC. Click 'Advanced client options' and tick 'Display performance information.' When you next stream a game you'll see the resolution and frames per second in the lower-left corner. Press F6 or an Xbox controller's guide button and Y to switch to a more in-depth chart.



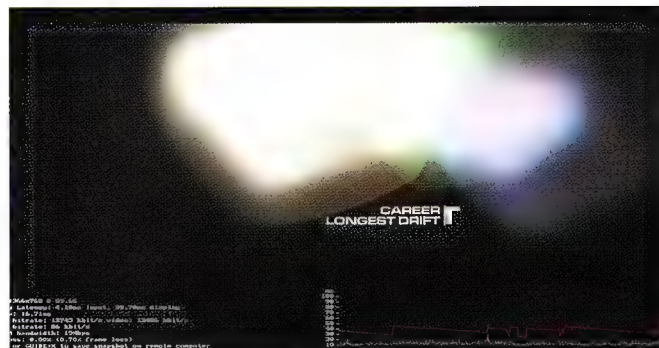
3 FLATLINING

Spikes in the dark blue line indicate that there's latency at the source computer's end, while peaks in the light blue line are due to network slowdowns. The red line represents the amount of time it's taking the client computer to decode and draw the current frame. This often ties in with the network line, as the client has to work harder to catch up on dropped frames while keeping things smooth.



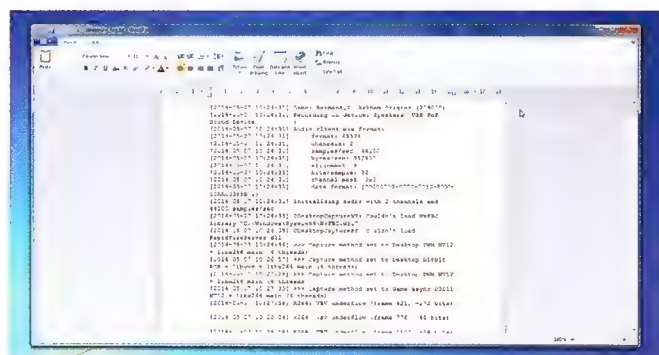
5 SLOW MOTION

Further down each section you'll see a bunch of stats including SlowGamePercent, SlowEncodePercent and SlowNetworkPercent, which will tell you what's causing the largest streaming issues, so look for high percentages here. It's also a good idea to keep an eye on AvgFPS and StdDevFPS to see if altering settings makes a difference.



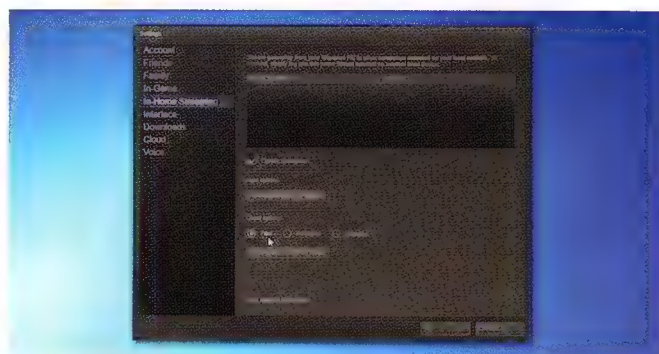
2 BLURRED LINES

You'll now see a graph at the bottom of the screen, and lots of statistics. If you're on a wireless connection, try running a game and moving around the house to see how it's affected. Peaks indicate latency, so ideally you want a nice low, flat line across all the different colours. The lines may go off the scale during periods of massive latency, but this doesn't mean your PC is about to explode.



4 CAPTAIN'S LOG

Steam constantly records stats while you're streaming. You'll find a text file named streaming_log.txt in the logs folder of your main Steam directory. This has some weird formatting, so you're best off opening it with Wordpad. It can look a little overwhelming at first, but it's easy to understand once you know what you're looking for. You'll see the relevant game's title at the beginning of each section.

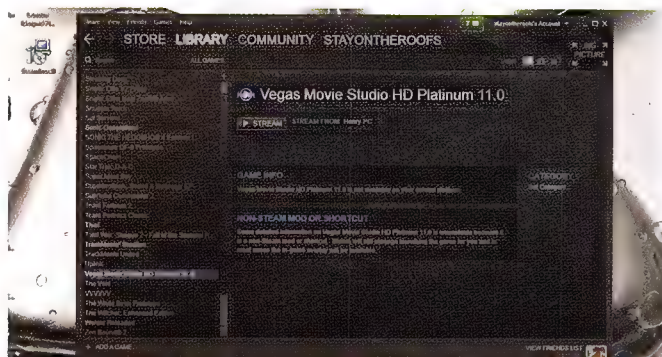


6 SORTED

SlowGamePercent and SlowEncodePercent indicate that there's a problem on the host PC, so try dropping the resolution in-game. SlowNetworkPercent suggests that your network is acting up. SlowDecodePercent is down to your client computer; tweak the client options in Steam's In-Home Streaming settings to lighten the load.

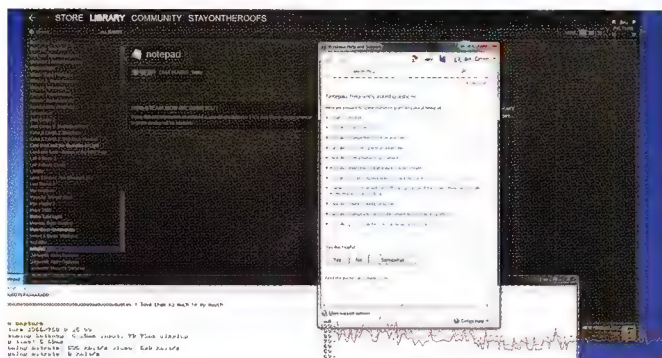
Non-Steam streams

Want to escape Valve's monopoly on PC gaming while exploiting its best features?



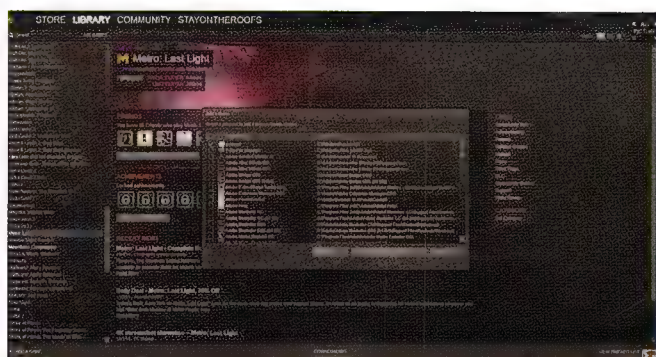
1 GET YOUR GAMES

On your source computer click Games and then 'Add a non-Steam game to my library'. Here you'll find a big list of all the software that currently resides on your computer, and you can add almost anything and everything. Use the checkboxes to choose which pieces of software show up in your Steam library. Bear in mind that this is not officially supported, so your results may vary.



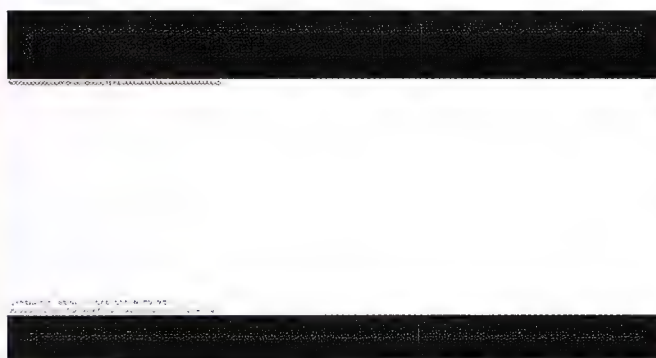
3 HELPING HAND

Now stream Notepad to your client PC and bask in the glory of a virtualised instance of Windows' most boring program. Now hit F1 to bring up Notepad's help. In doing so, you'll summon the Windows desktop. From here you can run programs, watch movies and access *Battlefield 4*'s needlessly complicated web-based launcher. You can set this to work from your client computer to your source, too.



2 DULY NOTED

You can also stream your source computer's entire desktop via Steam, although it's a bit of an odd workaround. On your source computer, add Notepad as a non-Steam game. You may not see it in your programs, in which case you'll need to browse to it. As it's buried in Windows' system folders, it's easiest to right-click its icon in the Start menu and copy its location from Properties.



4 GTFO

Once you've finished what you need to do via the desktop, you may find yourself stuck in the Microsoft equivalent of the Phantom Zone from *Superman II*. To escape, click on Notepad again, then press Alt-F4 to close it. This method works with other programs, too (we chose Notepad because it's the least system intensive), so try hitting F1 when you're streaming them and see what happens.



Play Steam games from afar

Steam's In-Home Streaming contains the phrase 'in-home' for a reason, but that doesn't mean you can't stream to a PC elsewhere with an internet connection. It's not officially supported, but it does work.

To set it up you need to convince both PCs that they're on the same network, which is where LogMeIn's Hamachi software comes in. Begin by visiting tinyurl.com/3kextgj and downloading it. Install it on both your source and client computers, choosing new computer names if necessary.

Create a new network with a unique

network ID and password on the source computer, and then use the client to join an existing network and enter the network ID and password. Hamachi will now link the two computers together via a virtual private network, and Steam will be convinced they're both in your house — even if they're miles apart.

Obviously a fast network connection is a given here, and you'll probably still get lag

from the speediest ISPs. Nevertheless, we tried *Dota 2* on a 3G HSDPA connection and it just about worked if we lowered settings across the board. It's better suited to more sedate turn-based strategies than fast-paced first-person shooters, too. ■



Maximizing performance per square inch

Tom McNamara crams two radiators, five fans, a dual-GPU video card, and an 850-watt power supply into a micro-ATX cube — no big deal.

Anyone can put some fancy gear into a regular tower case. It's like Lego, but not as expensive. With the growing trend toward shrinking cases, we like to challenge ourselves by maintaining silly amounts of performance within small real estate. We tried this route recently, featuring a mini-ITX tower from Silverstone and a GTX 780 Ti

video card from Nvidia, but there just wasn't enough physical space for the system to really shine. To achieve the power and cooling that we really wanted, we needed a bigger boat. This micro-ATX box is arguably our craziest attempt yet — not just in terms of how much mojo we've wedged in there, but also in how close this build came to not working at all. We

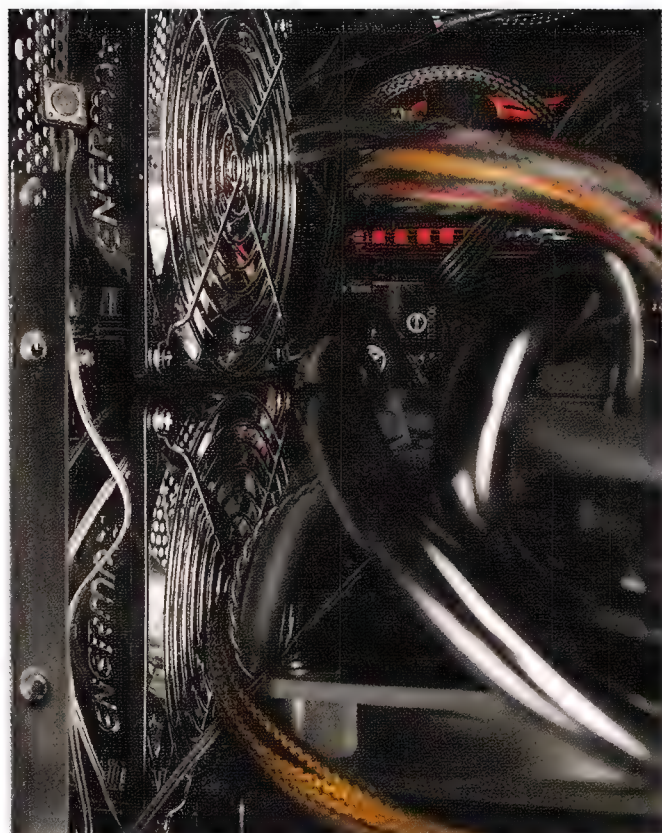
discovered that there was pretty much no margin for error, and a slightly different selection of hardware probably would have meant failure to launch. Some of it we got lucky with, while other things we had to replace or scrounge for. But we clawed our way to victory, because the idea was too audacious to merely daydream about.

TIMBO SHRIMP

We needed a solid foundation to house a card as beefy as a Radeon R9 295X2, which squeezes two 290X GPUs onto one dual-slot card and cools itself with an integrated 120mm closed-loop liquid cooler (CLC). We also decided on a 240mm CLC for our Intel Core i7-4770K. And the 295X2 alone would need a full-sized ATX power supply. But there aren't a lot of cases that can wrangle all this hardware and still provide enough ventilation to keep everyone happy. Luckily, we'd recently received a micro-ATX Bitfenix Colossus Mini, a shrink-ray version of the company's full-tower case. Not to be confused with the mini-ITX Mini, which is even mini-er. Our Mini had enough fan mounts and just enough internal real estate to close the deal. Barely. After some experimentation (explained later), we settled on the Lepa G850-MAS power supply, an 850-watt unit. This PSU fit the bill because its cables are clustered to one side of the unit, and it's been well-reviewed. Being a gold rated PSU didn't hurt, either. We needed a lot of power efficiency to make this build work. Our CPU got a Cooler Master Glacer 240L, a CLC with a 240mm radiator, to keep it nice and chilly. The connectors on the radiator end can swivel for a level of flexibility that you don't usually see with this type of unit. Our motherboard of choice was a micro-ATX Gigabyte Z97M-D3H, which gave us some ergonomic flexibility later on.

I'M YOUR BIGGEST FAN

The Bitfenix Colossus Mini comes with two 120mm stock fans. We removed them both and replaced them with a pair of Enermax T.B. Vegas fans that we wanted to test. This upgrades us from 3-pin to 4-pin fans, allowing us to control their speed ranges with instructions given to the motherboard. We salvaged a 4-pin splitter cable from a CLC kit to plug both fans into one mobo fan header. These fans install in the bottom as intakes, with their screws coming in from below. We added chrome grills to keep the blades from getting caught on anything. Safety first! You could also install a single 230mm fan in this spot instead.



PARTS LIST

	PART	PRICE
CASE	MICRO-ATX BITFENIX COLOSSUS MINI	\$110
PSU	LEPA G850-MAS	\$170
MOBO	GIGABYTE GA-Z97M-D3H	\$115
CPU	INTEL CORE I7-4770K	\$320
COOLER	COOLER MASTER GLACER 240L	\$120
GPU	AMD RADEON R9 295X2	\$1,500
RAM	2X8GB CORSAIR VENGEANCE DDR3/1600	\$70
SSD	SAMSUNG 840 PRO 500GB	\$255
CASE FAN	2X 120MM ENERMAX TB VEGAS	\$30
FAN CABLE	SILVERSTONE CPF01 PWM FAN SPLITTER	\$5
OS	WINDOWS 8.1 64-BIT OEM	\$100
TOTAL		\$2,795

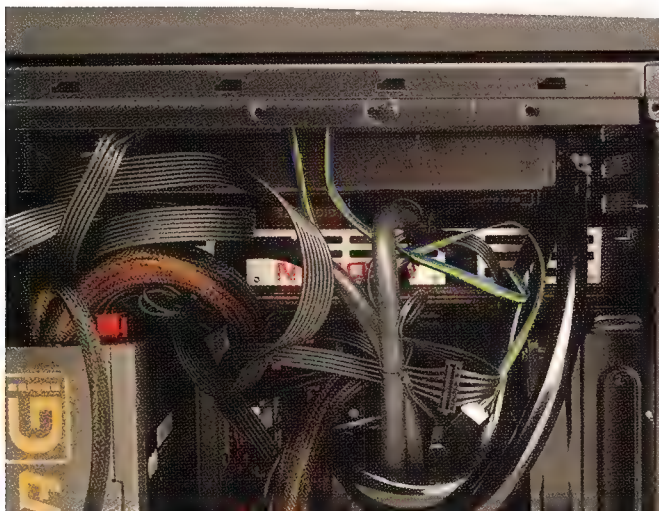
INSTALL THE COOLER

We knew we needed a boatload of power to handle this kind of gear, so we aimed for at least 850 watts. At the same time, the power supply couldn't be too beefy, because a 295X stretches across the entire length of this case and could obstruct the unit. Even with our connectors clustered to the left, we barely got the card to slide past the cables. It still blocks two connectors, but the two PCIe cables and the SATA power cable that we can attach are plenty for our purposes. The SATA cable will power an SSD and the CLC's pump. There's a second 8-pin CPU power cable coming out the back that we won't be using, but there's space to tuck it away on the other side of the PSU. Unfortunately, there isn't anywhere else to tuck other cables out of sight, but the Colossus Mini doesn't have a side window to expose our messy internals.



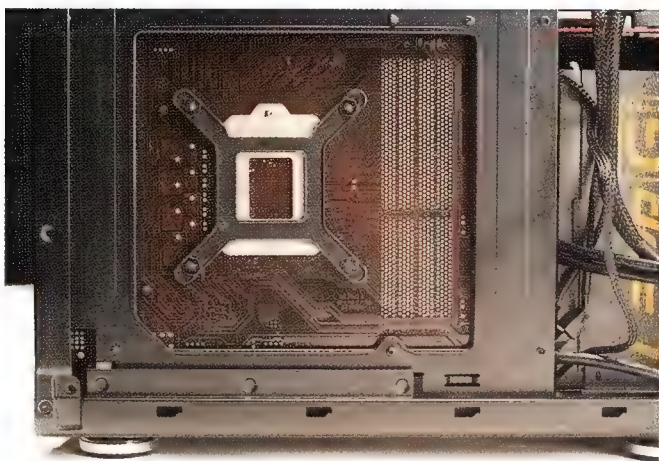
SEEING DOUBLE

Putting in the video card isn't as hard as it looks. It just needs to go in before the CPU's radiator does. The other cables pictured can be pulled out of the way. The tightest fit in this section was actually the card's own radiator, which gets close enough to the 295X2 to graze its backplate. Turned 180 degrees, the radiator would not fit. If the card was fatter than normal, the tubing on the radiator above it might not be bendy enough to get around. If the card were too tall, it would block our critical power supply connectors. Basically, AMD's reference dimensions were critical to our success.



X MARKS THE SPOT

The x-shaped bracket pictured is the backplate for our Cooler Master's Glacer 240L CPU cooler. This installation process became, shall we say, an enlightening challenge when confined to a Colossus Mini that was starting to fill up with hardware. In retrospect, installing the cooler first probably would have been better. The bracket doesn't stick through the other side of the motherboard, so it's difficult to fasten the heatsink's bracket to it. The backplate's adhesive pads are also very small and not very effective. Still, we were able to squeeze a 4.4GHz overclock out of our Core i7-4770K CPU, despite it competing with the video card for intake. The Gigabyte Z97M-D3H micro-ATX board is not a fancy unit, so we didn't expect record-breaking OCs anyway. The cooler's 240mm radiator also ended up blocking the other PCI Express slot on the motherboard when we installed it in the top of the case, so it turns out that a dual-GPU card was the best option after all.



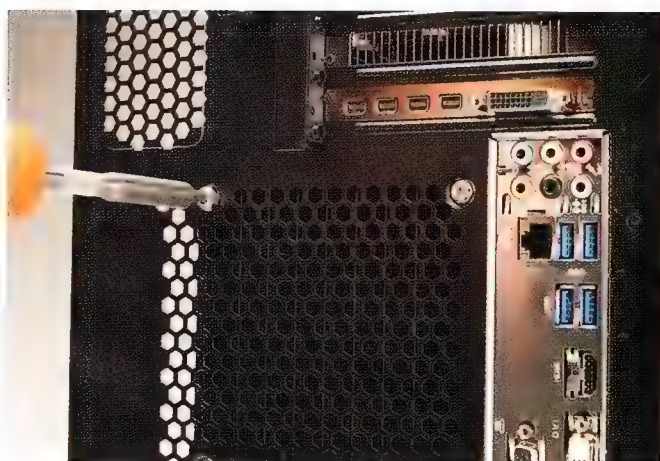
DO YOU EVEN FLIP?

The cooler master 240L comes with its fans preinstalled on the radiator, which has become increasingly popular. CM also attached the fans with small screws that can only be reached by a screwdriver with a narrow shaft. We had a Snap-On kit that fit the bill. We needed to flip the fans so that they would be pulling heat off the radiator and blowing it out of the case, instead of fighting the video card for intake. How is this possible? Well, the Colossus Mini has an inverted motherboard tray, so the mobo goes in upside down — putting the video card right below the 240L. This also put a bunch of USB, front-panel, and audio connectors at the top of the case, so we had to hook up those before they were blocked by the 240L's radiator. This meant reversing the Colossus Mini's side panels, which is why the white stripes on the side don't line up with the white stripe on the front; the case's power button is located on a side panel instead, making wiring a bit challenging.



RADICAL ENGINEERING

Installing the video card's radiator was pretty easy by comparison. We had already installed the CPU's heatsink with its tubing on the opposite side of the video card radiator's mount point. That way, the heatsink could be removed later, without having to take out the radiator first. The cable for its pre-attached 120mm fan is wired directly into the card and gets power right off of the PCI Express bus, which is a smart way of eliminating the need for an extra fan header on the motherboard. Likely buyers of this board will probably be using a lot of fan headers already, and this design keeps the cabling clean for showing off to your friends and neighbours. Our non-retail version of the card didn't come with mounting screws (the retail one does), but power-supply screws worked perfectly and are commonly found on most builders' workbenches. The part of the radiator where the tube goes in has some bulk, so it has to be on the bottom. There's literally no room to rotate it, because the video card is right there.





1 The connectors on this radiator can rotate a full 360 degrees, so maneuvering them around the video card wasn't a problem.

2 The 5.25-inch drive bay is secured with six screws, so we just pulled it out to make way for this 12.5-inch long video card.

3 The front of the case has a large grill that the power supply uses as an intake, helping it run coolly and efficiently.

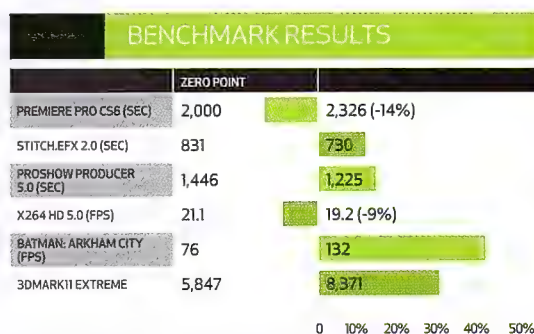
4 The rear of the case will fit a 140mm fan, but case fans installed right below would probably block a 140mm radiator.

THE LITTLE ENGINE THAT COULD

Were it not for our library of spare parts, this build might not have come together. The flip side is that we sometimes use a part or two that's hard to find at retail, like our Lepa G850-MAS, so the build ends up an experiment instead of something you could replicate. If you have a PSU that's semi-modular or non-modular, no longer than 6.3 inches, and provides about 850 watts or more, and its modular connectors are clustered close to the motherboard power cable, you may be in luck.

As for our storage devices, there's a metal plate for that, which screws in above the motherboard, and leaving it in during photography would have blocked the view of everything inside. Since it's just a plate with drive mounts on it, we simply left it out of the shots. But we can tell you that it could fit two 2.5-inch drives and one 3.5-inch drive. Your connectors can't go in at right angles, though, because the rear of the drive doesn't end up flush against the edge of the plate. Hopefully, Bitfenix will consider changing that in later versions of this case.

But you're probably wondering what the build felt like once it was finally up and running. Well, with two 290X GPUs along for the ride, we could max out all our game settings even at Ultra HD (aka 4K) res. We did usually disable anti-aliasing, because the much higher pixel density at 3,840 x 2,160 gains minimal visual improvements from AA but has a high performance cost. AMD's drivers also let us attempt to force Crossfire (the company's version of SLI) when a game didn't have a



THE ZERO-POINT MACHINE COMPARED HERE CONSISTS OF A 3.2GHZ CORE I7-3930K AND 16GB OF CORSAIR DDR3/1600 ON AN ASUS P9X79 DELUXE MOTHERBOARD. IT HAS A GEFORCE GTX 690, A CORSAIR NEUTRON GTX SSD, AND 64-BIT WINDOWS 7 PROFESSIONAL.

CF profile written for it, so that was nice. The motherboard handled a CPU overclock of 4.4GHz without breaking a sweat, keeping us surprisingly close to the zero-point machine's hex-core Core i7-3930K.

The fans on the 240mm radiator did get louder than we'd like. Even with the motherboard instructed to use a "silent" mode, the fans still cranked up to about 1,800rpm under load. The video card's radiator fan hardly made a peep, despite the card never hitting 70 degrees Celsius, so we know that the system was getting plenty of air. It could be that the 240L was fighting the 295's intake fan for air, despite the 240L's fans being on the other side of the rad. But overall, the build felt like a success, and we enjoyed learning more about space management. ■

Create a Pi-driven private cloud

Never lose control of your data by storing it in your own personal cloud.

Cloud services such as Dropbox have changed the way people collaborate and share files, but to get the most out of them, you have to trust your data to a third-party provider. This is where personal cloud storage software such as ownCloud steps in.

With ownCloud, you can sync and share your private data and access it from any device connected to the internet. For added security, ownCloud can also encrypt your files.

The software can handle files in a variety of formats and has a built-in gallery image viewer and a music player. One interesting feature included in ownCloud is file versioning, where the server tracks all changes to every file and you can revert to an older version with a single click.

As with other cloud storage services, you can sync files using the web browser or a desktop client on Windows, Mac and Linux, as well as mobile clients for Android and iOS.

INSTALL OWNCLOUD

The ownCloud developers have

streamlined the process of setting up an ownCloud server. Begin by ensuring the computer you'll be using as the ownCloud server has a static IP address. You can do this from your router's admin page. Next, fire up a terminal and add the ownCloud repositories:

```
# sudo -s
# echo 'deb http://download.opensuse.org/repositories/isv:ownCloud:community/xUbuntu_13.10/ /' >> /etc/apt/sources.list.d/owncloud.list
```

Before you can install software from this repository, you'll also need to add its signature key:

```
# wget http://download.opensuse.org/repositories/isv:ownCloud:community/xUbuntu_13.10/Release.key
# apt-key add - < Release.key
```

You can now refresh the repositories with `sudo apt-get update` and install the ownCloud server with `sudo apt-get install owncloud`.

The above command installs and configures the Apache web server to talk to the ownCloud installation. You need to enable certain Apache modules for ownCloud to work. In a terminal, enter `sudo a2enmod headers rewrite env` then restart Apache with `sudo service apache2 restart`.

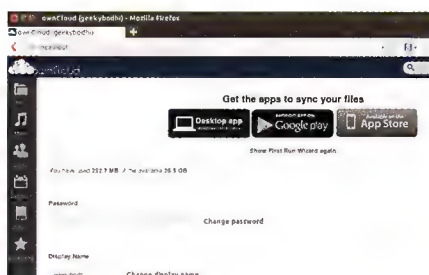
To configure ownCloud, launch a web browser and navigate to the ownCloud installation instance at `localhost/owncloud`. Because this is a new installation, you're asked to create a user account for the ownCloud administrator.

By default, ownCloud keeps its data under the `/var/www/html/owncloud/` data directory and uses the SQLite database. If you want to use another database, such as MySQL, or want to change the data folder, click on the Advanced pull-down menu. You should change the location of the data folder – for example to `/var/data` – otherwise ownCloud will throw errors.

You can now log into your ownCloud server as the administrator and start uploading files you want to share. But

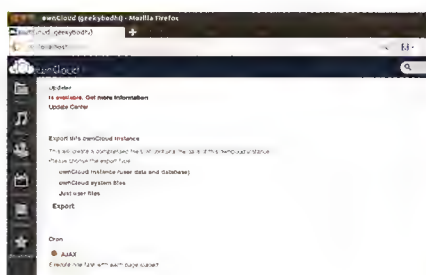
Basic ownCloud configuration

Get your cloud up and running.



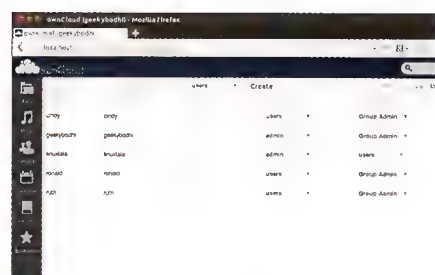
1 PERSONAL SETTINGS

When you are logged into the ownCloud server, click on the pull-down menu next to your username and then click on Personal. Here you can change the settings for your account, such as the login password and display name.



2 TWEAK OWNCLOUD

Bring up the pull-down menu again and click on Admin. From here you can check for available updates and create a compressed backup of the entire cloud. You can also enforce the clients to connect to ownCloud via an encrypted connection.



3 USER MANAGEMENT

Before you can start using your ownCloud instance, it's advisable to add users and organise them into different groups. If you are logged in as the ownCloud admin, select Users from the pull-down menu to manage your users.

before you do that, you'll have to tweak the configuration file of PHP if you wish to upload files that are greater than 2MB in size. To do that, open the PHP configuration file, `php.ini` under `/etc/php5/apache2`, in a text editor. Look for the `upload_max_filesize` and `post_max_size` variables and change their value from 2M to something like 500M or 1G.

UPLOAD AND SHARE FILES

You're now all set to upload data into your ownCloud server. After you've logged in, you are in the Files section. To upload a file, you can click on the green arrow button or just drag and drop from your desktop. To organise your files into a folder, click on the button labelled New, and select the Folder option from the drop-down.

If you've uploaded a file in a format that ownCloud understands, you can click on its name to view and edit the file. The Music section lists all your uploaded music files irrespective of the folders they are in. At the top of the page, you get buttons to control playback. Simply click on a file to add it to the playlist.

Similarly, the Pictures section shows thumbnails of all the images in your cloud. Click on an image to start a slideshow. The interface has controls to pause the slideshow and to jump to the next or previous image.

Another way to upload files to the server is by using the WebDAV protocol, with which you can access the ownCloud server from your file manager. For example, in the Files file manager, press Ctrl-L to enable the location area. Here you can point to your ownCloud server, such as `dav://localhost/owncloud/remote.php/webdav`. Once you've authenticated, the ownCloud storage is mounted and you can interact with it just like a regular folder.

To share uploaded files, go to the Files section in the web interface and hover over the file or folder you wish to share. This displays several options, including Share, which lets you select which users or groups you want to share the item with, and whether you want to give them permission to edit and delete the files. You can also share an item with someone who isn't on your ownCloud server. When you click on 'Share with link', ownCloud displays a link to the item, which you can share with anybody on the internet. You can also password-protect the link and set an expiration date.

SET UP CLIENTS

You can also synchronise folders from any desktop to your ownCloud server using an ownCloud client. To install a Linux client, add its repo by entering the following in a terminal:

```
$ sudo -s
# echo 'deb http://download.
opensuse.org/repositories/
isv:ownCloud:devel/
xUbuntu_13.10/ '/' >> /etc/apt/
sources.list.d/owncloud-client.
list
```

Then add the keys with:

```
# wget http://download.
opensuse.org/repositories/
isv:ownCloud:devel/
xUbuntu_13.10/Release-key
# apt-key add - < Release-key
```

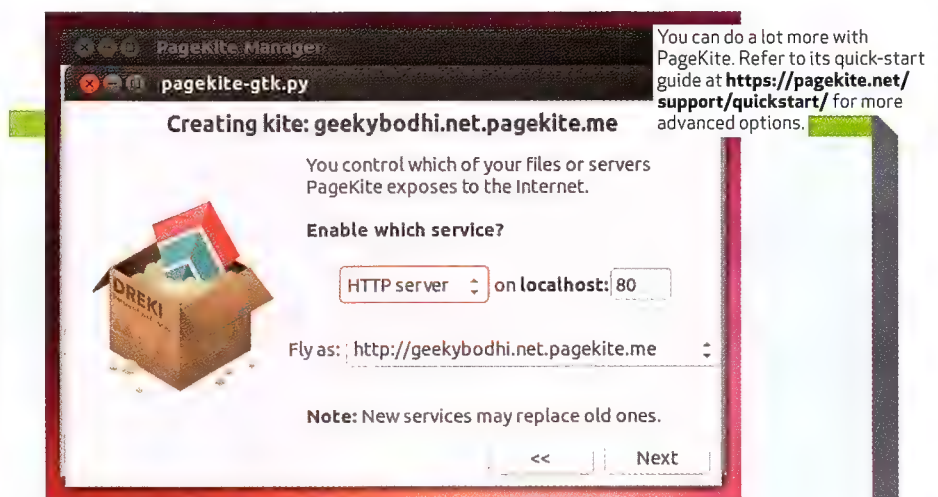
Finally, refresh the repos with `sudo apt-get update` and install the client with `sudo apt-get install owncloud-client`.

Once the client is installed, you have

to set it up it by pointing to the server. It connects and, by default, creates a local sync folder named ownCloud under the home directory, such as `/home/bodhi/ownCloud`. Any files you move into this directory are synced to the server.

You can also specify one or more directories on a local machine to sync with the ownCloud server. If a directory is shared with several users, when anyone makes a change to a file on one computer, it flows across to the others.

When collaborating with other people, ownCloud's version control system creates backups of files, which are then accessible via the History pull-down option, which also links to an 'All versions....' page where you can roll a file back to a previous version.



Access ownCloud from the web

The real advantage of commercial cloud services such as Dropbox is that you can access data stored within them from any computer connected to the internet. However, by default ownCloud is only accessible from computers within the network it's set up on.

But that's not to say that you can't access your private cloud from the internet. The trickier and expensive solution is to get a static IP address from your ISP and then poke holes in your router's firewall to allow traffic from the internet to find your cloud. Or set up Dynamic DNS in your router or local machine.

The smart way is to use a tunnelling service such as PageKite, which can make your private cloud visible to visitors from the internet with minimum effort. PageKite uses a pay-what-you-want model. As a non-commercial user, you can use it for free by filling out a form once a month, telling PageKite how you use the service. To install it, launch a terminal and enter:

```
$ curl -s https://pagekite-net/pk/ | sudo bash
```

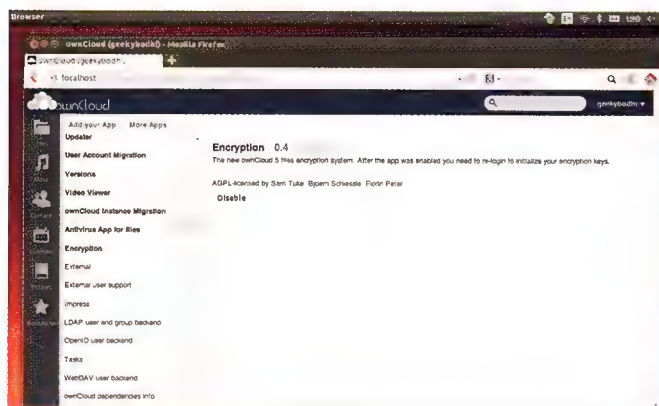
When it's done, make your local web server public with the following command:

```
$ pagekite.py 80 mycloudserver.pagekite.me
```

Now you can access your ownCloud instance by entering the **mycloudserver.pagekite.me** URL in a web browser. Remember to replace mycloudserver with any name. The first time you run this command, PageKite runs you through its brief sign-up process and asks for your email address.

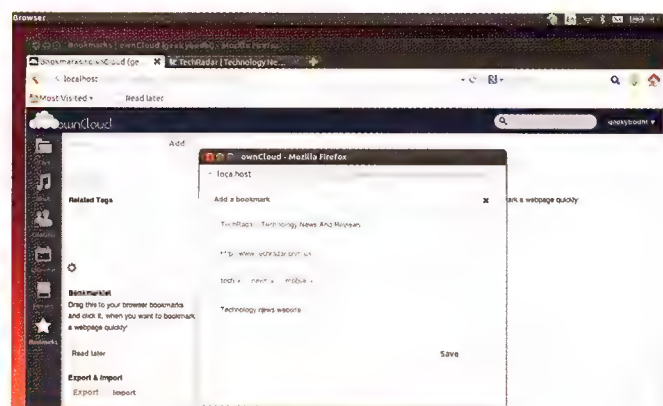
Install and enable apps

Use these add-on apps to extend ownCloud.



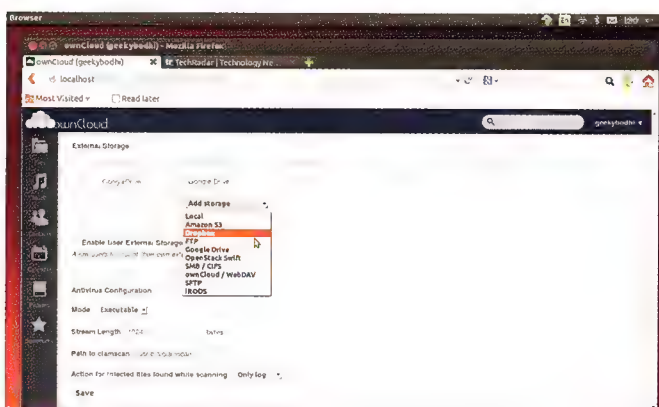
1 ENCRYPTION

Bring up the pull-down menu next to your username and click on Apps. This lists a number of add-on apps you can install to extend the functionality of your ownCloud installation. Scroll down the list and select Encryption. Click on the Enable button to activate the app. When you log in to your server again, it generates encryption keys and encrypts all the data on the server.



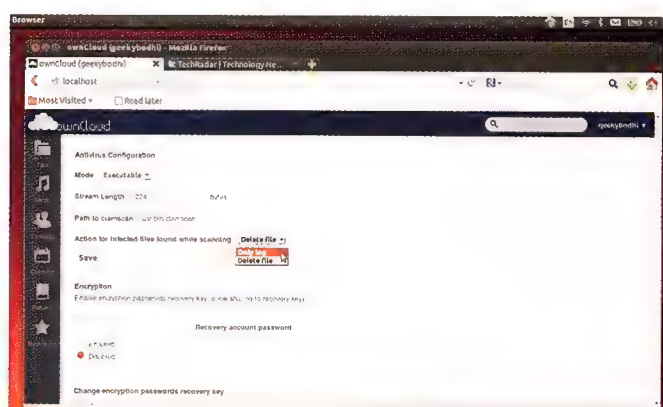
2 BOOKMARKS

After you have enabled the Bookmarks app, you can store and manage bookmarks in your ownCloud server. You can use bookmarks by adding them directly, or by importing a bookmark file from your web browser. The app also has a bookmarklet that you can add to your browser's bookmarks. Press the bookmarklet to add a web site to ownCloud's list of bookmarks.



3 EXTERNAL STORAGE SUPPORT

With this app you can mount drives and manage data from external third-party storage services, such as Amazon S3 and Dropbox. After enabling the app, head to the Admin section, which will have a new External Storage section. To add a new drive, select a service from the pull-down list and key in the required authentication details to enable ownCloud to connect to the service.

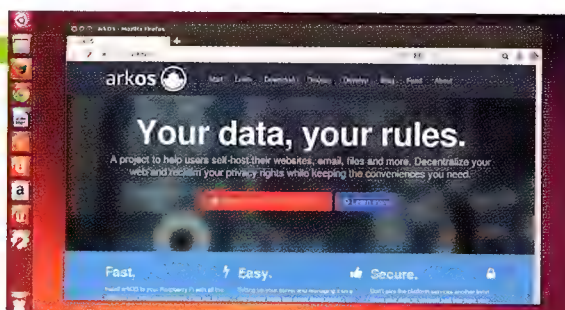


4 ANTIVIRUS

The app checks files with the ClamAV scanner when they are uploaded to the server. Enable the app and head to the Admin section to configure the app. You need to point to the path of the executable Clamscan app and also select the action to take for infected files. The default action is to log any infected files it finds, but you can also choose to delete them.

Initial Pi set up

One of the primary reasons for not running your own cloud server is that it has to be kept powered on around the clock. This could be a costly affair and might not even be feasible if you live somewhere that's prone to power cuts. But if your file requirements are modest, you can easily use the puny Raspberry Pi as the server. You'll need to tweak the device to allocate maximum RAM to the processor instead of the GPU before installing the ownCloud software in your RPi. You can automate the process by using a script from petRockBlog (<https://github.com/petrockblog/OwncloudPie>) which downloads and sets up an ownCloud installation on your Raspberry Pi on top of the Rasbian distribution.

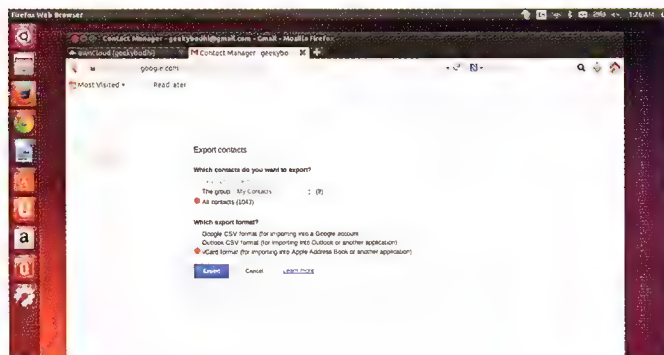


The RPi is an ideal device to power your personal cloud.

Or if you are really adventurous, you can install arkOS (<https://arkos.io/>) on your RPi. In addition to ownCloud, the distro has other apps to keep you in charge of your data.

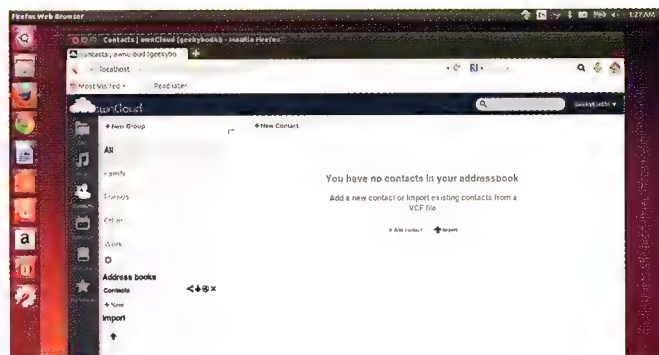
Sync your calendar and address book

Import them into the cloud and sync across desktop and devices.



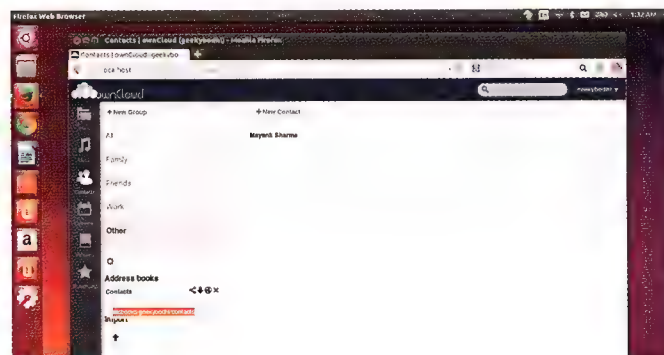
1 EXPORT CONTACTS

With ownCloud, you can keep your contacts in sync. Before you can do that, however, you need to get them into your ownCloud server. OwnCloud supports the popular vCard file format (with the .vcf file extension), and almost every popular emailing app, including online ones such as Gmail, exports its address book in this format.



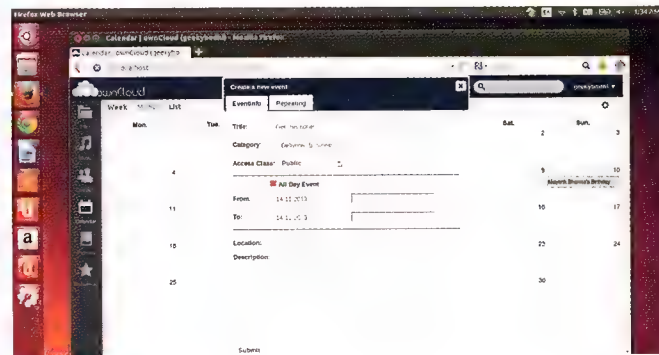
2 IMPORT INTO OWNCLOUD

With the .vcf file in hand, head to the Contacts section in the ownCloud admin interface and click on the Gears icon in the bottom-left. This opens up the Address books drawer, which helps you create a new address book to import your contacts into. Click on the arrow button and use the file manager to find and select the .vcf file.



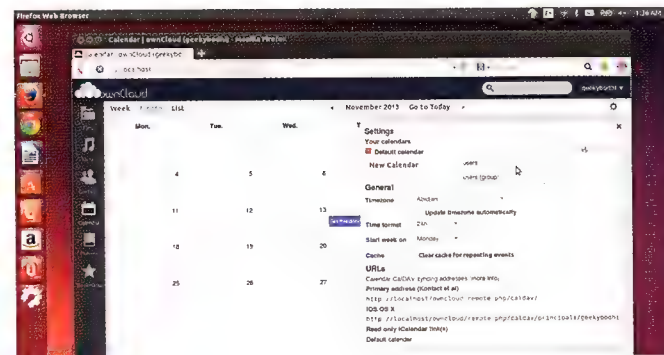
3 SYNC THE ADDRESS BOOK

You can sync the address book with clients that can read CardDAV links. Head over to the Contacts section, click on the Gears icon, hover over the name of the address book you just imported and click on the Globe icon. This spits out a CardDAV link for this address book that you can feed to your desktop or mobile address book client.



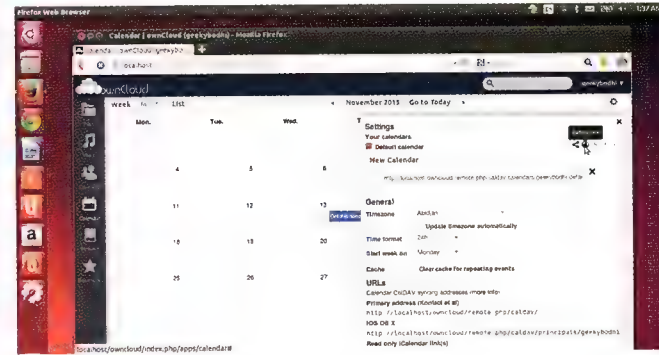
4 EDIT CALENDAR

OwnCloud can also manage your calendar and tasks. To create an event in your calendar, head over to the Calendar section. You can view the calendar for the entire month or for the current week. To add an event, click on a date in the calendar. This brings up a window that gives you several options to configure the event.



5 SHARE WITH OTHERS

After you have saved an event, you can use ownCloud to share it with other users. Click on the Gears button in the top-right corner. Hover over the calendar you wish to share and click on the 'Share Calendar' icon. This brings up a pull-down menu which enables you to select the users or the group of users you wish to share the calendar with.



6 SYNC WITH DESKTOP

Just like address books, ownCloud can also sync your calendars with desktop and mobile apps that can read this information from CalDAV links. To get the CalDAV link for your calendar, click on the Gears button then on the Globe. This displays the link that you can pass on to the clients to keep them in sync with the ownCloud calendar. ■

Run KitKat on your PC

Not sure if your phone will ever see Android 4.4.2?

Skip it — run KitKat on your computer instead.

Darren Yates shows you how.

If Android has an Achilles heel, it's the whole problematic OS update mechanism that relies on at least two (more probably three) different companies getting together to agree on whether a release for a particular device will happen. Google may well announce an OS update, but it's up to the device manufacturer to add in the appropriate device drivers and the phone network provider to test it against the 3G/4G network before you're any hope of seeing an 'update available' message.

But if you're still waiting for KitKat to make an appearance on your favourite Android device, there's no need to wait — just install it on a PC instead.

ANDROID-x86 4.4.2

Thanks to the team at the Android-x86 project (www.android-x86.org), the latest Release Candidate 2 (RC2) image of KitKat for Intel x86 CPU-based systems has been released — and it's pretty darn good.

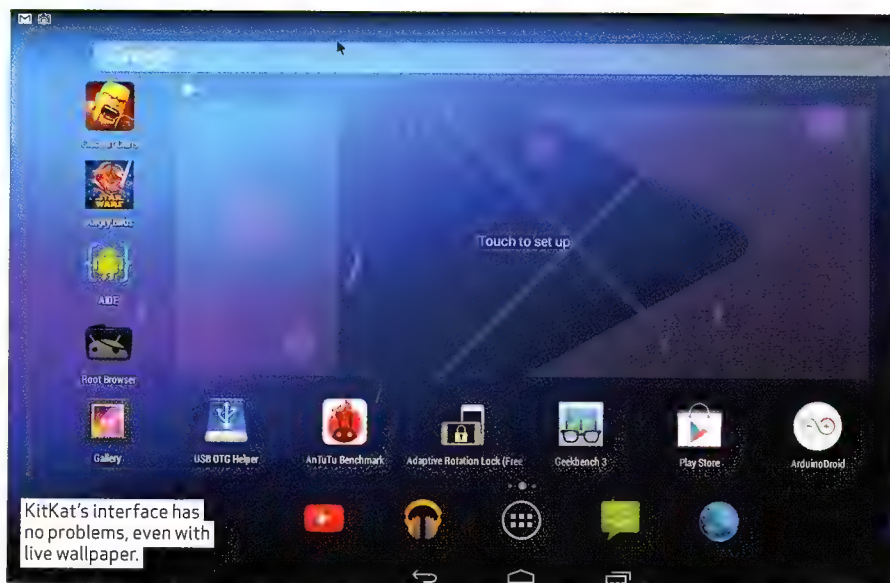
Some readers may remember we took a look at a test build of Jelly Bean/4.3 last year. The good news is this new KitKat version is greatly improved, fixes many of the issues we saw last time and is still easy to install.

INSTALLING KITKAT ON REAL HARDWARE

Android-x86 4.4.2/KitKat comes as a 330MB ISO image you can install on

Your mileage may vary

Because we cannot guarantee Android-x86 4.4.2 has every device driver your PC or notebook may need, we recommend using a spare x86 computer and/or hard drive you don't mind reformatting. Keeping the computer's original hard drive intact saves you from backup dilemmas if Android-x86 doesn't work for you. That said, we had few issues running KitKat on our test notebook.



any system as a software-only build through a virtualisation app such as VMWare Player 6, but nothing beats installing KitKat on real Intel x86 hardware for getting the best Android experience.

Like we did last time, we tested this new release using an old Compaq Presario CQ42-136TU notebook with a 1.9GHz Intel Celeron T3100 dual-core CPU and 2GB of RAM. Yep, it's hardly state-of-the-art — but we've chosen it specifically to show you how well KitKat performs, even on older hardware.

Because of its relatively small size, you can burn the ISO image straight to a CD-R disc or, better still, flash it to a 1GB or larger USB flash drive and create your own Android Live USB drive. Either way, you can try out Android without installing it onto your computer's hard drive by using the distro's built-in 'live' option that launches the OS into RAM. But really, you should install it onto a physical drive and run it as a real system. That, of course, means you either have to backup all of the important files from the computer's existing hard drive (since installing Android will require a complete wipe and format), or you do what we do and replace the original drive with a new one.

TOP TIP: TRY AN SSD

The fact KitKat comes as a 330MB ISO image and writes only around 700MB of data to the drive means this is a great opportunity to replace the old platter-drive with a small-capacity solid-state drive. It's a good idea for multiple reasons — first, you get to keep the computer's original drive in working order, without having to spend time backing everything up. Second, you don't need a high-capacity SSD — even a 32GB version will be fine (few Android phones or tablets feature more than this, anyway). We threw an old 64GB OCZ Vertex 2 SSD into the breach here — its capacity is too small for Windows, but perfect for Android and gives the system a nice boost in responsiveness. And yes, KitKat supports TRIM so there are no worries about abandoned block reclamation or system slowdown. (If you're in the market, try a budget 60GB Kingston SSDNow V300 model for around \$60.)

We've included guides on creating the Android Live USB drive plus how to install the OS onto your computer — if you've installed Windows or Linux previously, you won't have too many problems here.

HOW DOES IT PERFORM?

When we tested Android-x86 4.3/Jelly Bean last year, we were impressed by its overall performance, despite the fact that our particular Intel x86 CPU wasn't really in Android's wheelhouse. But roll on near enough to 12 months later and the improvements are considerable. Not only does it feel like the Android-x86 team has gained considerable experience in the intervening period, the whole Android-on-x86 concept has gained momentum, thanks to Intel itself.

We've seen a noticeable rise in the number of new Intel Atom Z37xx CPU-powered Android tablets this year — ASUS' latest MeMO Tab 7 releases a case in point. The chip giant has taken some time to get its low-power CPU strategy into place and while it's still a long way off from knocking chief rival ARM off its perch, Intel looks like it's starting to hit its straps in this arena.

Unlike the Jelly Bean/4.3 release, this new RC2 image has root-access baked in, which instantly makes it a far more interesting distro to use. We had no trouble getting Google's Chrome browser installed and working, but there is now also far greater support for x86 within Google Play. Previously, we had to use a Market Helper app to trick Google Play into thinking our notebook was a Galaxy S3 smartphone in order to install games such as *Angry Birds*. This time around, these apps install as a matter of course.

GAMING

And while we're at it, let's talk gaming. The Celeron T3100 mobile dual-core



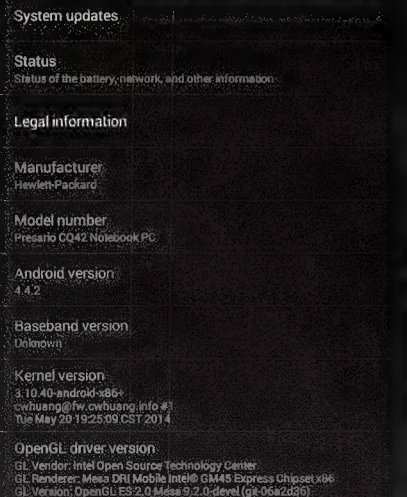
Angry Birds Star Wars runs effortlessly smooth even on a 2008-era CPU.

CPU is a 2008-vintage chip bundled with Intel GMA4500 integrated chipset graphics, so we're not talking GeForce or Radeon here. But it handles *Angry Birds Star Wars* beautifully and if you're a *Clash of Clans* fan, you'll be trading gems and mining gold and elixir before you know it. Still, it has to be said, not every game worked — *Rivals At War* wouldn't run, neither would *iFighter*. To be fair, we'd blame the ageing GMA4500 graphics engine for a lack of recent 3D functionality. The OS has OpenGL ES hardware acceleration for Intel and AMD Radeon GPUs built-in, but we doubt support goes back as far as GMA4500.

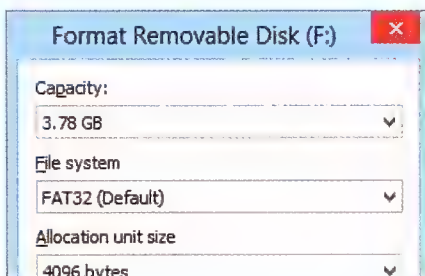
However, there may be a further issue in this instance.

Android-x86 uses a code module called a 'binary translator', which converts ARM-class pre-compiled

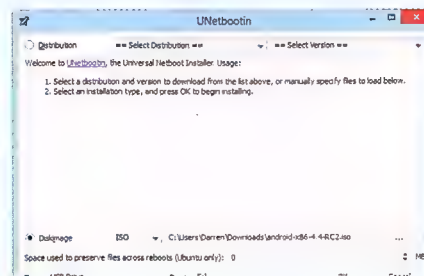
Android-x86 KitKat should run on most notebooks and netbooks.



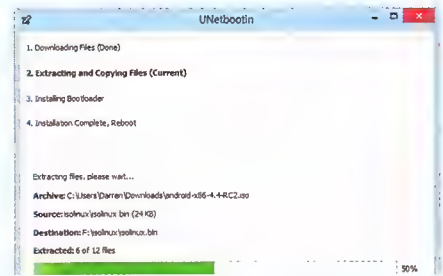
Create a Live USB drive



1 **DOWNLOAD THE ANDROID ISO**
Download the Android-x86 KitKat 4.4.2 RC2 ISO image from tinyurl.com/kitkatx86 and get the latest version of UNetbootin from tinyurl.com/winunetbootin. Grab a USB flash drive of at least 1GB, plug it into your PC and format it (backup any important files first).



2 **LAUNCH UNETBOOTIN**
Launch UNetbootin and make sure the flash drive appears in the Drive list at the bottom of the window. Click the radiobutton next to DiskImage, click the '...' browse button on the far right and select the location of your ISO image.



3 **CREATE THE BOOTABLE DRIVE**
With the ISO image and USB flash drive selected, click the OK button and UNetbootin will create your bootable Android Live USB flash drive.

binary code into x86-compatible speak for Intel CPUs. Rival chip designer ARM claims this binary translation adds an extra load onto gaming performance – and it very likely does, but you'll never get Intel and ARM agreeing on just how much (www.tinyurl.com/lv7dnzp).

The beauty of the Java programming language used to make most Android apps is that it's architecture-independent – you write once, run it everywhere. But for code that is pre-compiled (usually found in games for faster, more consistent speed), that code has to be translated since it's normally compiled for ARM CPUs, not Intel. Again, we doubt the translator here has our Celeron T3100 CPU or its GMA4500 graphics engine in mind.

DEVICE AND VIDEO SUPPORT

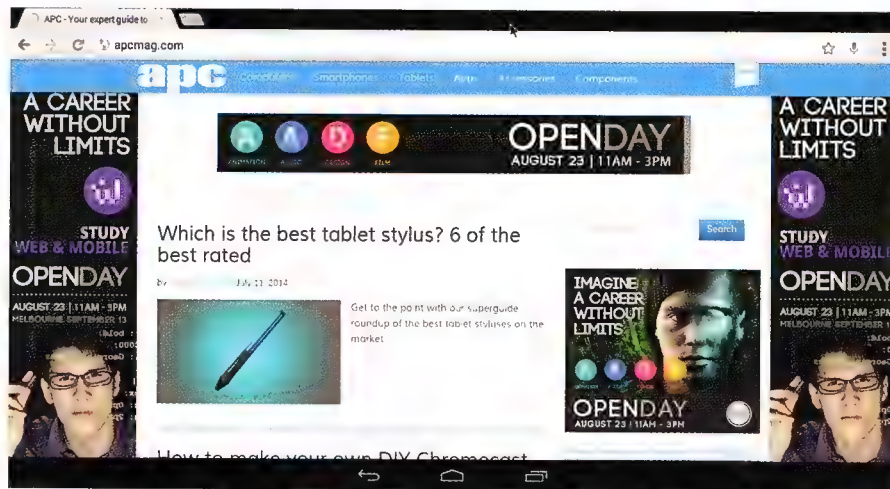
The good news is that the majority of the CQ42's integrated devices worked out of the box – we had audio (including keyboard volume control), external USB, Wi-Fi and even power management all up and running, which bodes well for other notebooks. DHCP-configured Ethernet is also said to be available but we haven't tried it as yet.

The notebook's 1,366 x 768-pixel LCD panel also runs at native resolution but while the on-board webcam performance was fine for still images, it's too slow for video. The only component of note that didn't work at all was the on-board DVD burner but again, Android doesn't do optical media in any case.

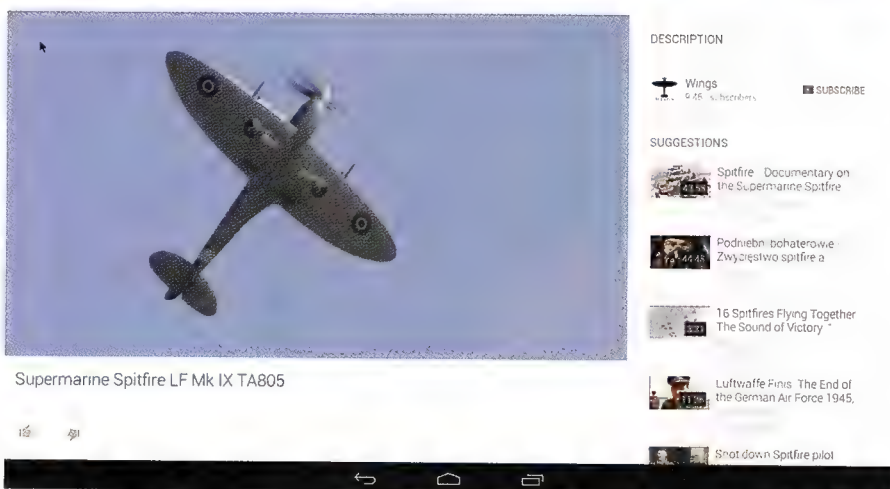
Video playback though was excellent – adding a decent video player such as MX Player is a must, but even so, we had no trouble playing 1080p MPEG4 video from a USB flash drive on our notebook with no obvious jitter or frame dumping. That's not bad for a dual-core Celeron CPU. The Android-x86 team has added the popular ffmpeg (libavcodec) codec engine to provide greater video codec support for Stagefright, the media player architecture inside Android. We couldn't fault it.

WHAT DOESN'T WORK?

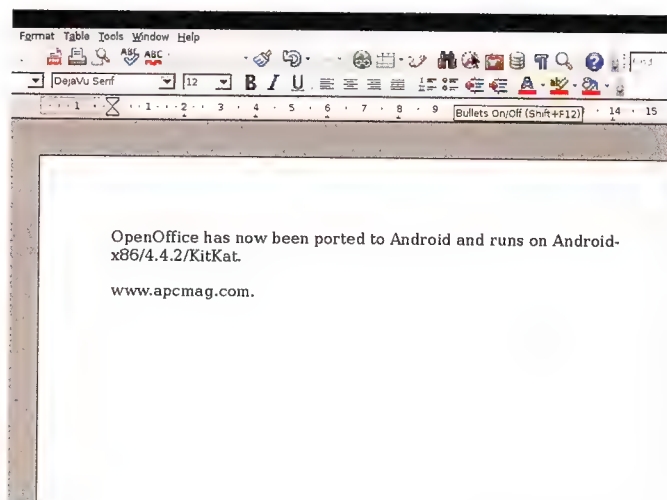
Apart from the non-functioning DVD burner and the slow webcam, we couldn't get KitKat's Cast Screen (Miracast) feature to run, but again, you need supported hardware for that, something you won't get in a 2008-era notebook. Still, as we've seen recently, there are plenty of ways to create a Chromecast-like setup without actually using Miracast or a Chromecast dongle (read my how-to story at apcmag.com/how-to-make-your-own-diy-chromecast.htm). But there is one feature that is definitely a no-go.



Google's Chrome browser now works perfectly.



Video playback quality is excellent; YouTube is fine, even at HD resolution.



AndrOpen Office is the Android port of OpenOffice.org.

NO ART

One of the big-budget additions to KitKat is the new Android RunTime (ART) engine that Google plans to replace the ageing Dalvik engine with. KitKat has Dalvik as the default option, but you may be aware that by tapping five times on the Android 'build number' entry in the Settings/About tablet menu, you can activate the 'developer options' and enable the ART

engine in place of Dalvik.

But here's why you don't want to try it here. We gave it a go and upon the mandatory reboot, all we got was a never-ending view of the Android logo with no way to repair it – except for a complete reinstall and considerable face-palming.

BENCHMARK TESTING

While the GMA4500 graphics engine

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Telephone Auto Dialler



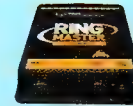
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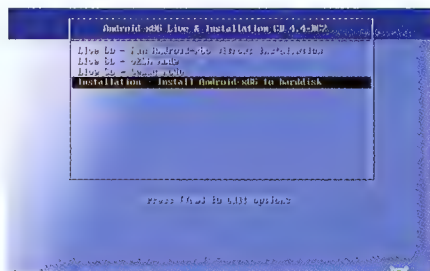
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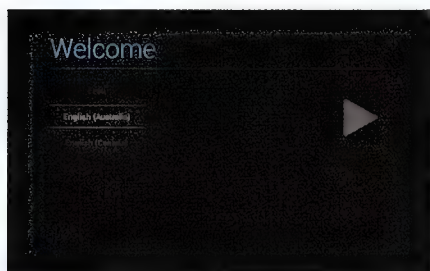
Visit our comprehensive Web Site for information, brochures, prices, installation diagrams or to place an order.

Install Android KitKat on your PC

WARNING – This process wipes the contents of your PC's hard drive.



- 1 BOOT UP**
Boot your PC from the Live USB drive you've just made, select Installation from the menu.



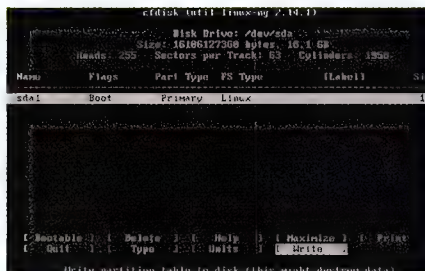
- 4 FOLLOW THE PROMPTS**
Android 4.4.2 should now boot up on your PC. You don't need to do anything until you see the Android Welcome screen — from then on, just follow the prompts.

may struggle with 3D gaming, the dual-core Celeron T3100 CPU has plenty of zip for an old chip. We ran a couple of generic benchmarks and the results are surprisingly decent. AnTuTu came back with a score of 21,059 — faster than the Samsung Galaxy S3 and on a par with the Galaxy Note 2. GeekBench 3.0 returned a single/multi-core score set of 964/1723, which puts it ahead of the LG-built Nexus 4 phone and just behind the ASUS-made Nexus 7 (2013) tablet.

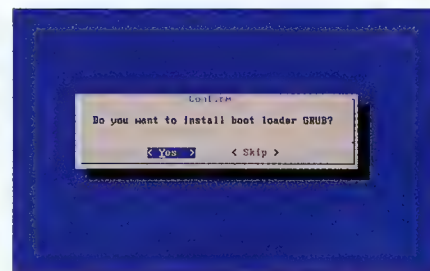
MUST-HAVE APPS

Running KitKat on this notebook has been a surprisingly enjoyable experience overall, but to help you get up and running faster, here are a few must-have additions:

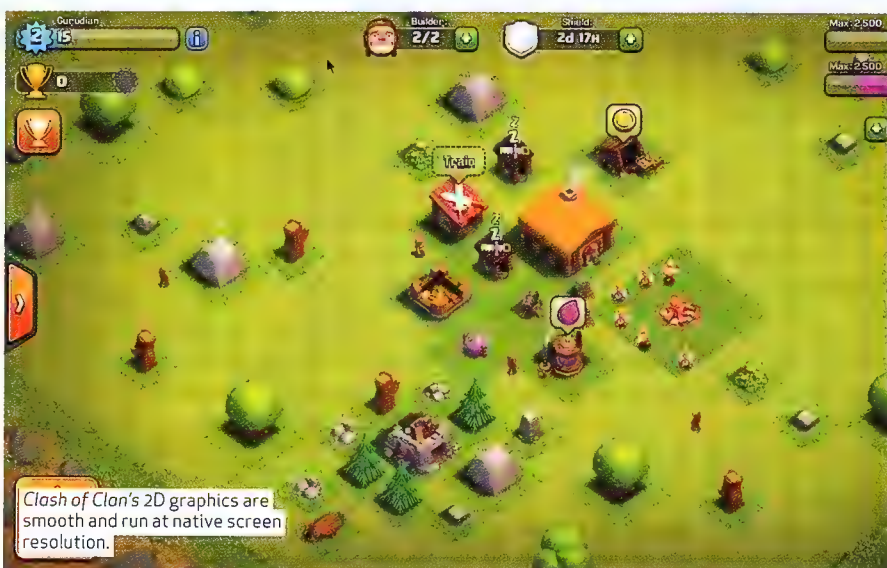
- **Adaptive Rotation Lock** — stops apps from turning the screen orientation to portrait.
- **Root Browser** — lets you browse the complete filesystem, not just the user folders.
- **MX Player (with x86 codec pack)** — best app for playing 1080p videos.



- 2 CREATE A PARTITION**
On the 'Choose Partition' screen, select Create/Modify Partitions to launch the cfdisk utility. If there are any existing partitions, use the right arrow key, scroll to delete, press the Enter key. Repeat until all partitions are removed. With no partitions shown, select New, then Primary. Press Enter again to use the full drive capacity, and again to make the partition Bootable. Scroll across using the right-arrow key until you get to Write (it auto-wraps), press Enter, type 'yes' to confirm and press Enter again to write a partition. When you see the main menu again, scroll to Quit and press Enter.



- 3 INSTALL BOOT LOADER**
On the 'Choose Partition' screen again, select 'sda1 Linux' and press Enter. Now on the Choose Filesystem screen, select 'ext3', press Enter. Select Yes to confirm. When you see 'install boot loader GRUB', choose Yes. Next, you'll be asked if you want the /system directory as 'read/write'. Again, select Yes. Once the OS is written, choose Reboot and remove the USB flash drive from your PC.



- **Root Checker** — a good way to make sure you have root-access available.

GIVE IT A GO

This KitKat/4.4.2 release of Android-x86 is easily the best-featured and most stable we've seen so far. However, it's small 330MB ISO image means it'll probably be a bit of a lottery as to whether it'll have every device driver needed to make your notebook or PC work to the fullest extent. While

we fared remarkably well on that score, ultimately, your mileage may vary.

But if you have a notebook or PC gathering dust or holding up a set of shelves, why not dust it off, fire it up and give this distro a go? Given how well it performs on low-power ARM-based devices, Android could well be the ultimate OS to keep your older hardware ticking over. And it won't cost you much to find out, either! ■

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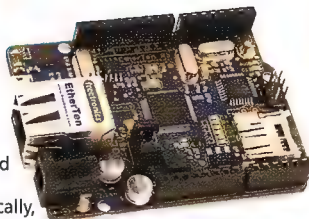
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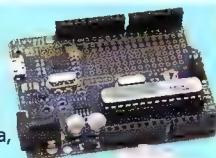


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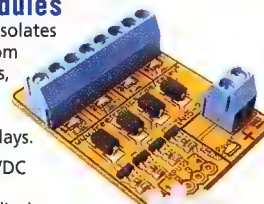
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Wireless Arduino

Learn how to drive an Arduino Uno board from your Android phone or tablet using a low-cost Bluetooth module. Darren Yates explains.

Long-time readers will know I'm not one to promote trendy marketing phrases and certainly 'Internet of Things' or 'IoT' is right up there with the best (worst) of them. But the concept behind the phrase is worth understanding as it drives the next generation of connected devices. Single-function or 'embedded' gadgets built from microcontrollers like the Arduino's Atmel ATMEGA328P can now jump on-board the internet, thanks to the proliferation of low-cost wireless connectivity.

So this month, we're introducing you to the developer's view of Bluetooth with a basic example of how to connect an Arduino Uno to an Android device using this low-power wireless technology.

WIRELESS LIGHT 'N' SOUND

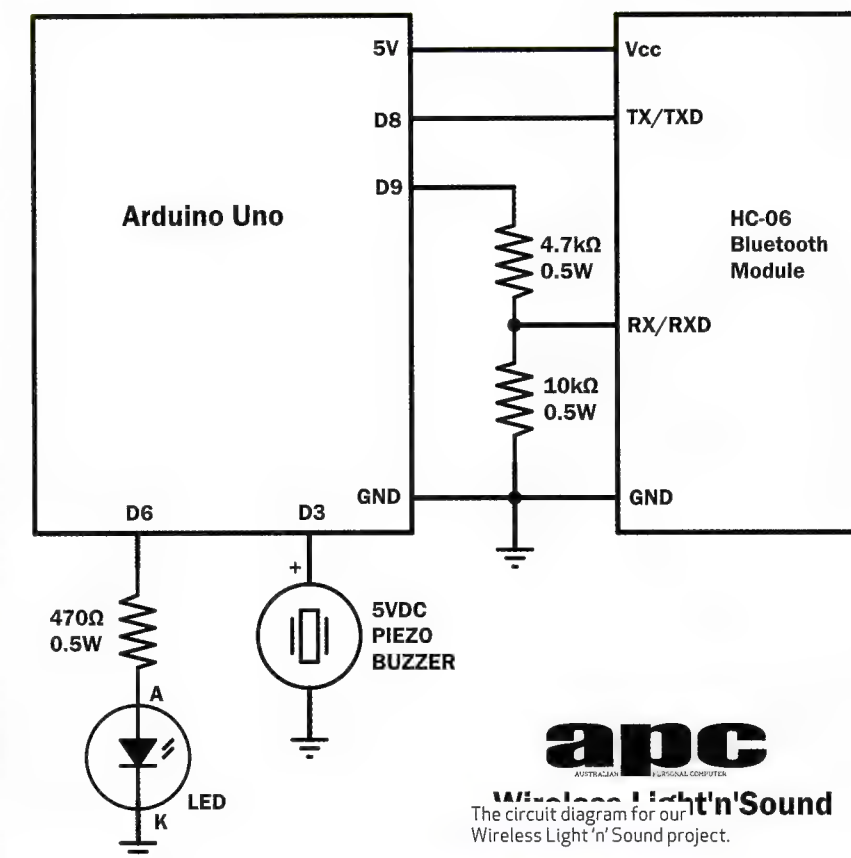
And to do that, we've come up with a project guaranteed to provide seconds of memorable entertainment that lets you turn a piezo buzzer on and off, plus fade an LED up and down. It's called (drumroll, please) Wireless Light 'n' Sound. OK, so it won't turn up on a TED talk any time soon – but, you'll learn how to add Bluetooth connectivity to your own projects. And all for less than \$6.

CHEAP BLUETOOTH HARDWARE

Not that long ago, adding wireless to anything used to cost and arm and a leg, but in recent times, Bluetooth technology prices have crashed dived and you can now pick up an HC-06 Arduino-ready Bluetooth transceiver (that's transmitter and receiver) for under \$6, including shipping.

Bluetooth is a low-power personal-area-network wireless communications standard that's good for up to 10 metres in 'clear air' (meaning 'no obstacles'). But the beauty of the HC-06 is that, to the Arduino Uno, it looks like just a standard serial device. There isn't even a special library you have to add.

There's just one small problem – the Arduino Uno only has one serial port, consisting of pins D0 (RX) and D1 (TX)



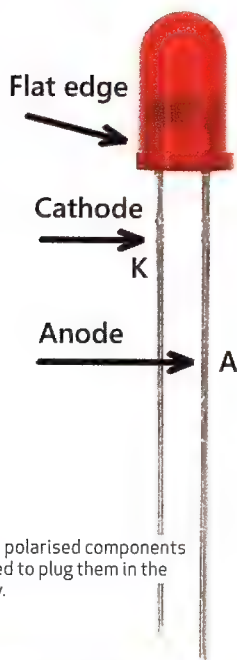
– and it's normally used, first, to upload your sketch to the Uno's on-board program storage; and second, to provide rudimentary debugging via the Serial Monitor. If we pinch the Serial port for the Bluetooth module, neither of those other two functions will work.

But this isn't an uncommon problem for the Uno and the Arduino IDE has a built-in solution called SoftwareSerial. The idea is to simulate a real serial port in software, allowing us to use any two other digital pins to do the job and it works extremely well – except here. Unfortunately, the SoftwareSerial library is a bit slow, but we've found an alternative software serial library that, unsurprisingly, is called the Alternative Software Serial library or AltSoftSerial (www.pjrc.com/teensy/td_libs_AltSoftSerial.html). It's stunningly easy to use and works perfectly.

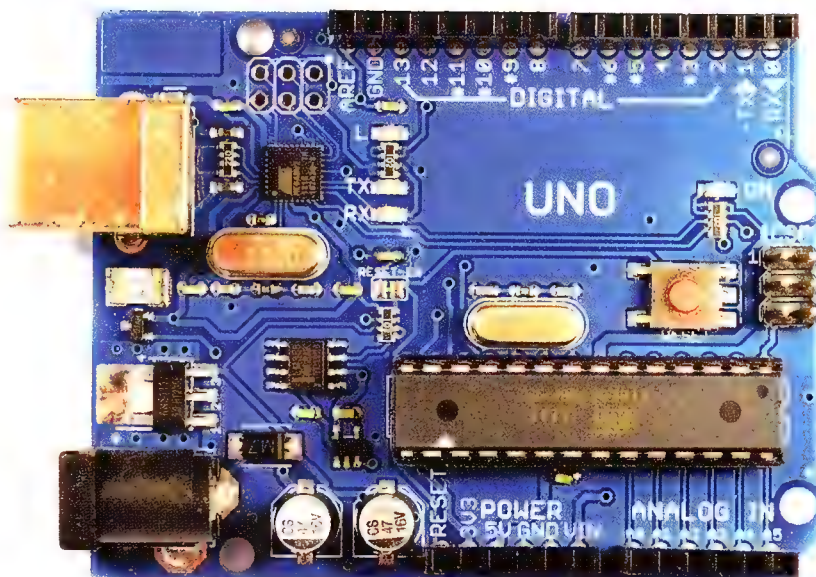
OUR PROJECT

You can see the design of our project in the circuit diagram (above). The HC-06 module has just four pins – transmit (TX), receive (RX), Vcc (5V) and GND (0V). It's designed to work off a 5VDC voltage rail, however, the logic level (the voltage level of the data) is only 3.3V, so in order to protect the Bluetooth module from blowing up, we're providing its RX input with a simple voltage divider consisting of a 4.7Kohm and 10kohm resistor that drops the 5VDC output of the Arduino's D9 pin to the required 3.3V (or thereabouts).

The rest of the project hardware is very simple – we've connected an LED to the Arduino's D6 pin in series with a 470ohm resistor, plus a 5VDC piezo buzzer to pin D3 (you can pick up these piezo buzzers for about \$2 on eBay).



LEDs are polarised components – you need to plug them in the right way.



Our project is powered by an Arduino Uno microcontroller board.

DIY PROTO SHIELD

We've built our project again using the Arduino DIY proto shield. It combines a general-purpose adapter board or 'shield' with a tiny breadboard to create your own circuits with easy-to-use dupont wires. These shields are available on eBay for around \$5, including shipping and they're an ideal way of creating your own small Arduino-powered electronic circuits.

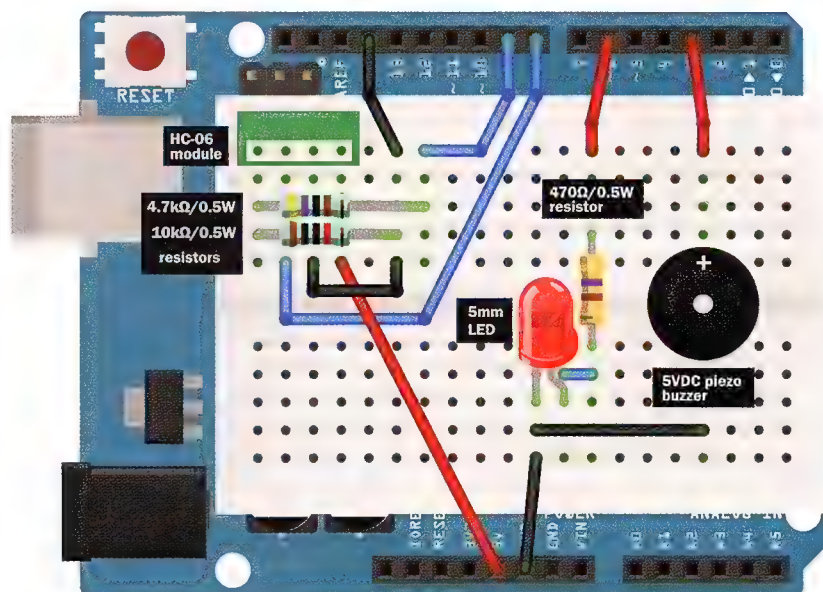
ANDROID SOFTWARE

To control our project, we first need an Android tablet or smartphone with built-in Bluetooth, along with a free Google Play app called Ardudroid (tinyurl.com/lefovgh). The interface is fairly Spartan, but it provides everything we need to control our hardware.

POWERING UP THE PROJECT

Grab the source code/sketch for this project from our Arduino page and load it into your Arduino Uno board. When the project is first powered up, the pairing LED on the Bluetooth module should flash rapidly. Go to your Android device, make sure Bluetooth is switched on, launch Ardudroid and press the Menu button. Select 'Connect me to a Bluetooth device' and press the Scan for Devices button if you don't see any entries. When the Bluetooth module appears, tap on that entry and within a couple of seconds, you'll be asked for the module passcode. It'll either be '1111' or '1234'. A couple of seconds after entering the correct code, that pairing LED on the module should light up solid and the app will indicate the two are now linked or 'paired'.

On the top of the Ardudroid app window, you'll see a series of 12



apc Wireless Light'n'Sound Overlay Diagram

Use this overlay diagram to build the project.

buttons – these are toggle buttons that send the corresponding Arduino digital port output alternately high and low. If you've wired the project correctly, pressing the 3 button should sound off the buzzer. Tap it again and it should stop.

Underneath those buttons are a series of sliders – these provide a pseudo-analog output using the Arduino's pulse-width modulation (PWM) on pins 6, 9, 10 and 11. Now unfortunately, our use of the AltSoftSerial library means the Arduino D10 pin is no longer useable, but you can still choose from the other three PWM ports. If you drag the pin 06 slider, you should see the LED now fade

up and down. Buttons 08 and 09 are also out of action – they're working now as a software serial port.

IF YOU CAN DO THAT

Sure, this isn't the most exciting project, but if you can build it and get it working, you have any number of creative possibilities – for example, with the right hardware, a phone-controlled low-voltage LED light dimmer. Or even a phone-controlled robot or drone. If you have skills in Java programming, you can even create your own Android app with a more targeted user interface for specific projects. All you need is your imagination.

Bluetooth Arduino – how it works

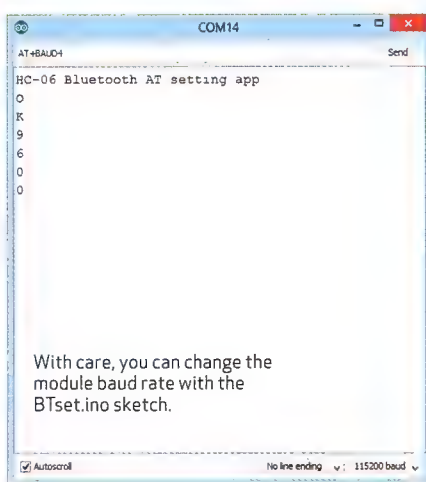
Our Wireless Light 'n' Sound project might be simple enough, but if you want to master Bluetooth communications with your Arduino projects, it's well worth understanding what goes on under the bonnet.

SERIAL COMMUNICATIONS

The HC-06 Bluetooth module is really a stand-alone unit – you don't need to provide any specific code to interface it with your Arduino. Just apply power and it's up and running, it'll even appear on and pair up to your Android device. What you need to take care of is the data available in the HC-06's on-board RAM, the data received from your Android device.

We'll look at the data specifically in a moment, but it's important to understand how your Arduino communicates with the HC-06 module. If you remember back to the old PSTN modem days, asynchronous serial communications with a PC required a basic two-wire standard consisting of a number of data bits, stop bits and parity bits. The most common of these was, and still is, known as the '8-N-1' configuration – it uses 8-bits for data, one 'stop' bit and no parity or error correction bits. The rate of data transfer can also be set and it's known as the 'Baud rate', measured in bits per second.

The HC-06 defaults to a 9600 Baud data rate and uses the '8-N-1' config. Connecting the HC-06 to the Arduino



Uno is a case of cross-wiring – the HC-06's transmit (TX) pin goes to the Arduino's designated receive (RX) pin and vice versa.

ALTSOFTSERIAL LIBRARY

If you look at our project source code, we set up or 'initialise' an AltSoftSerial object called 'arduinoBT' and set its data rate to 9600 to match the HC-06 module using the begin command inside the setup method.

Once inside the main loop method, we first flush the 'arduinoBT' serial port and then wait until some data becomes available in the HC-06 module's RAM – this indicates the module has received data from another Bluetooth device (namely, our Ardudroid app and our Android device).

ARDUDROID SEND CODES

We're using a small subset of the Ardudroid's capabilities for our project here but nonetheless, it's all we need. When you tap one of the buttons on the app, it immediately transmits special control codes via the device's Bluetooth feature. The first is a '*' character, indicating the start of a new command (you can see this in the 'define' area of our source code).

The Ardudroid software then sends a command code, indicating which type of control it is. Code '10' indicates a digital write – either '1' or '0' output – whereas code '11' is an analog write, which uses pulse-width modulation (PWM) to set the average output voltage to a level proportional to the following data.

The next data transmitted is the pin code, indicating which Arduino pin is to be set and is a number between 2 and 13. Finally, there's the output data code – '2' for a low digital output, '3' for a high. For an analog write, it's anything between '0' and '255'. The source code in your Arduino project must recognise and handle these codes. Follow our example and you'll see how it works.

The 'analogwrite' code is quite simple – if the code is an 'analog write', we use the Arduino 'analogWrite' command and send the output data code to the appropriate pin. For a 'digitalWrite' command, we cheat slightly – if an Ardudroid digital write command sends with it a '2' to indicate a low logic-level and '3' for a high-level code, we subtract two from that data code and we now have either '0' or '1'. We send this to the appropriate digital output, which knows already that a '0' means zero/no voltage and a '1' means high/5VDC output.

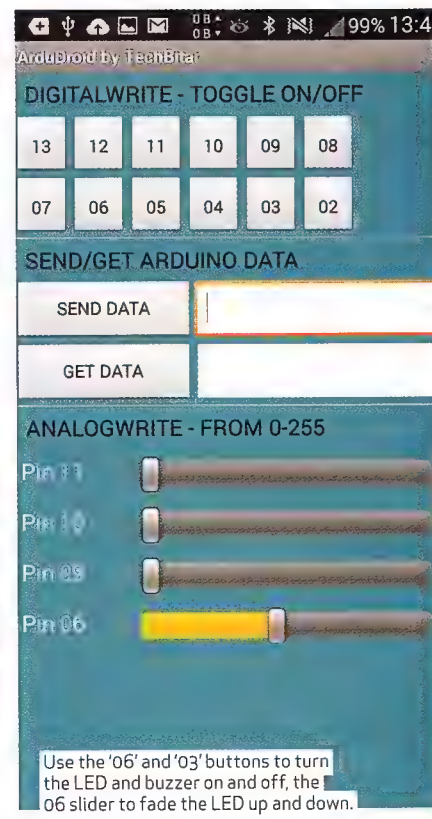
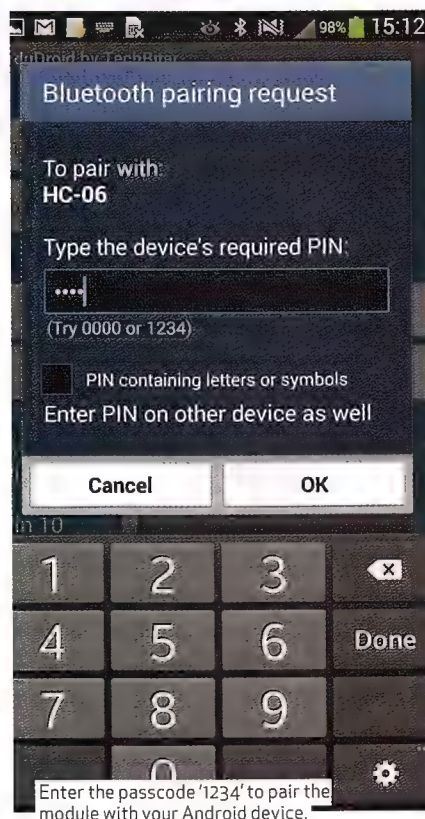
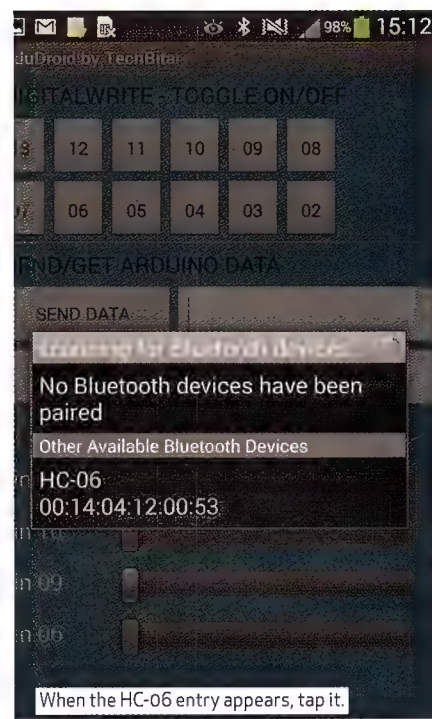
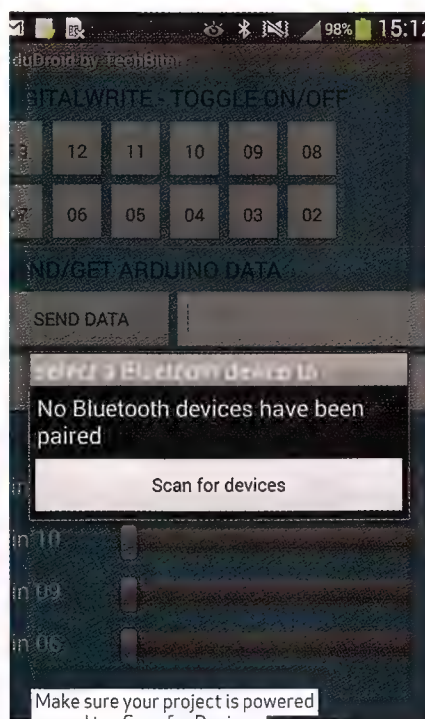
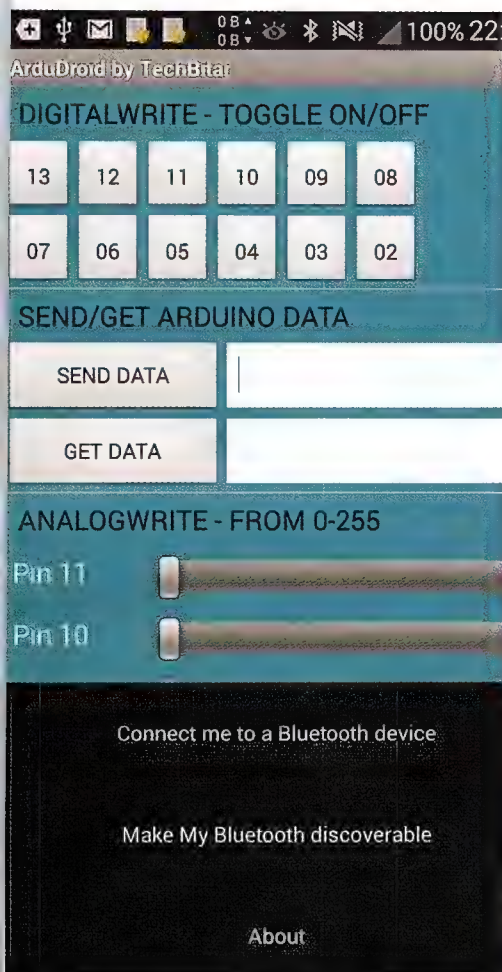
A PWM output won't suit every project, but it's great for dimming LEDs as we are doing here. Try swapping it with the piezo buzzer to see what happens (HINT: the buzzer just sounds weird because it is a mechanical vibrating layer that is designed for a fixed voltage).

MODIFYING THE MODULE

While the HC-06 is set by default to 9600 Baud, you can change it and a number of other parameters using your Arduino Uno project and a different sketch. The module supports a basic set of Hayes-like AT commands for setting the baud rate, the module name and the pairing passcode.

Where to get the software

You'll find the Ardudroid software free on Google Play. The sketch/ source code for the Arduino Uno can be found, as usual, on our Arduino webpage at apcmag.com/arduino.htm. Copy the contents of the libraries subfolder into your Arduino IDE's libraries folder. The Bluetooth.ino file is the project; the BTset.ino file is to modify the HC-06 module. While the software has been tested, it comes with no warranty, so use it at your own risk.



Launch ArduDroid on your Bluetooth-ready Android device, tap the Menu button and 'Connect me to a Bluetooth device'.

WARNING – Do not set the baud rate beyond 115,200 or you will no longer be able to use it with your Arduino Uno or the Arduino IDE.

Using the BTset.ino sketch, you type the command into the Serial Monitor text box and press the Send button. The display below will indicate the return from the module. Here's a basic list of the commands:

- **AT** – short for attention, a simple greeting to the module and you should receive an OK as basic confirmation a link exists.
- **AT+BAUDx** – replace the 'x' with the single-digit number indicating the desired baud rate, as follows: 1-1200 baud, 2-2400, 3-4800, 4-9600 (default), 5-19200, 6-38400, 7-57600, 8-115200. A correct return will be OK plus the new baud rate, e.g. OK19200.
- **AT+NAMEname** – replace 'name' with whatever you want to appear when the module is detected. Maximum 20 characters are allowed. The correct return will be OKname.
- **AT+PINxxxx** – set a new four-digit passcode by replacing the 'xxxx'. The correct return will be OKsetpin. Note, these changes are permanent – even when the power is removed.

Also, if you change the baud rate, you'll need to reset your sketch code so that the software serial port now matches the new module speed, otherwise, you won't be able to communicate with the module – that means you must write down the new baud rate as soon as you change it. And make sure it's no greater than 115,200bps.

GIVE IT A GO

The great thing about Bluetooth is that it's now cheap enough to incorporate wireless connectivity into any project and offer multiple-channel output control. If you can build your own Android apps, you can even bring the worlds of Arduino and Android together for infinite possibilities. ■

downtime

» GAMES - EDITED BY TROY COLEMAN

This is why you can't get a Lancia Delta insured anymore.



FROM \$69 | PC, XBOX 360, PS3 | WWW.GRIDGAME.COM

Grid Autosport

Career mode frills and Californian accents are cast aside in this racer.

Grid Autosport succeeds because it doesn't overstretch itself. There's no expanded management element here, nor any new curios like Grid 2's dynamically changing track layouts. Instead, Codemasters focuses on improving the series' already impressive AI, delivering a firm and fun handling model and setting it to task in five key disciplines: touring cars, endurance, open wheel, tuner and street. Compete for teams in these disciplines to fulfil sponsor objectives and earn XP,

then unlock more events in faster cars. Simple.

Perhaps the best thing Grid Autosport does is place you more often than not in the middle of the pack. There's probably some rubber-banding at work, but it's much subtler than any of Autosport's contemporaries. We're used to having slightly better acceleration than the AI in racing games (spoiler: that's why you always win) but here, you don't. You have better brakes. That means in order to take a place, you need to line up an opponent, anticipate his braking point, then either brake

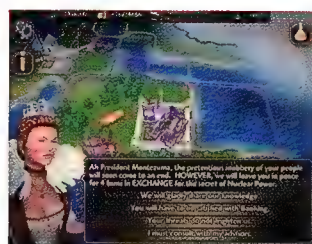
slightly later or pick a wider line and brake earlier, hoping to carry more speed out of the apex. In either event, they usually re-pass you. Suddenly, fifth place becomes a towering achievement. Trying to fulfil a sponsor objective that demands you drive a clean race and still bag the podium necessary to win the championship becomes the single hardest and most rewarding thing you've recently done in a racing game. It's excellent.

MORE TOUR

It's great to see touring events return to the series.

They are elbows-out affairs that the AI seems to enjoy as much as you. Whereas most racers give you a procession of Sunday drivers obsessed with each other's rear bumpers, Autosport provides a ferocious rabble, just one braking zone away from a five-car pile-up. Opponent behaviour is impressive across all race types, but it's most keenly witnessed in this weapons-free discipline.

They, like you, have other considerations during open wheel and endurance events. Lightweight formula



vehicles are remarkably allergic to high-speed impacts as it turns out, so AI aggression is muted here for obvious reasons. Conversely, endurance cars can take a bit more of a battering, but everyone's trying to keep their tyres fresh in these night-time runs and so drive much more conservatively (it's a lot more fun than it sounds). Tuner and street event types are a bit less engaging, if only because they revert into what *Grid Autosport* is largely departing from: that homogenised muscle car bombast we all got bored with five *Need for Speeds* ago. Plaudits are due for the edge-of-your-seat drift handling, but broadly these events are what made

predecessor *Grid 2* feel like a bit of a sell-out. We'd highly recommend the use of a gamepad rather than keyboard to make your life easier. Handling isn't a revelation – *Autosport* neither attempts nor succeeds in beating artisanal projects like *Assetto Corsa* or *Project Cars* at their own game – but it is a further improvement on an hugely gratifying drive. It's less twitchy than *Grid 2*, with a forgiving slip angle that lets you wrestle a drifting car back from the edge of disaster and gives great feedback. You're getting the picture by now: *Grid Autosport* is all the best bits of *Grid* and *Grid 2*, distilled into a focused and finely-tuned

racer. The more easily distracted, impulsive racing game fan will occasionally lament the familiarity; the growing sense that you're playing *Race Driver Grid: Remastered*. But in the heat of the moment in any of this game's disciplines, these misgivings swiftly melt away and all that remains is the exhilaration of scraping past a Ravenwest on the final corner. ■ Phil Iwaniuk

Verdict

No flashy new features, just magnificent racing based on a refinement of *Grid's* greatness.

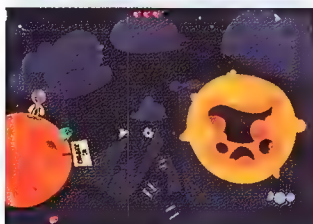
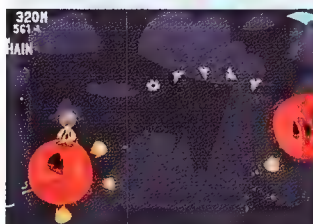
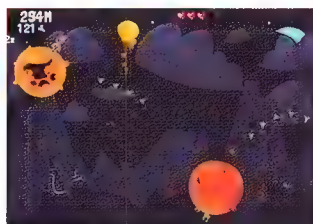
★★★★★

Civilization Revolution 2

Take over the world, wherever you are!

FROM \$18.99 | IOS
2K.COM/GAMES

The aim of *Civ Rev 2* is the same as the first — discover the world, build cities, become the dominant people, by peaceful means or not — but with less micromanaging, making for more approachable and faster games. It's almost identical, but with 3D graphics. There are leaders to be (or oppose), new research and (some) new units to command, but little has changed deep down. In some ways, this is great — it retains the original's feeling of strategy without spending hours poring over stats — but it's a shame not to have a sequel develop the formula meaningfully. If you've already played *Civ Rev*, the new stuff won't stay fresh long. Still, if you're new to the series, you'll find it's a great adaptation of the sprawling, lengthy desktop version. Games still take ages, but turns are faster. Many of the desktop game's complex systems are here but made less involved. The flip side is that some systems have been simplified too far; some removals feel needless and restrictive and make you feel like specialising your civilisation isn't as important. It can also be quite bad at explaining how some things work. If you own the first *Civ Rev*, take off a star (it's too similar), but otherwise, its fun conquers its flaws enough to be worth the price. ■ Matt Bolton



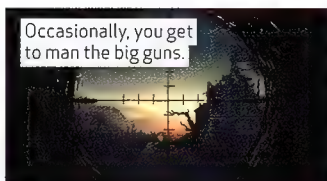
Beyond Gravity

Lots of small leaps for mankind.

\$0.99 | ANDROID, IOS
QWIBOO.COM

As first glance, it doesn't seem like there's enough to this simple platformer to keep it interesting. You make an astronaut jump from one spinning planet to another, picking up bolts as you go. You time jumps so your trajectory is the same as the lines of bolts, making sure to land safely on the next planet. The only control is the jump, and, yes, at first we found it rather slight. The variety and obstacles are minimal, too — planets spin in different directions at faster speeds, and watch out for comets. Yet we've been playing a lot, and really enjoying it. The 'variety' isn't really the point in the end — it's the rhythm and feel. Collecting complete rows of bolts builds a multiplier, making for a compelling high-score system, and collecting bolts, with a little shudder of the screen each time, is nicely satisfying. With upgrades to collect for too, it's a great little time-waster.

■ Matt Bolton



Occasionally, you get to man the big guns.



Freddie and Emile meet.



A rare moment when Walt the dog needs — rather than offers — help.



Anna, the game's medic, seeks out distress calls and offers healing.

FROM US\$14.99 | PC, XBOX 360, XBOX ONE, PS3, PS4 | VALIANTHEARTS.UBI.COM

Valiant Hearts: The Great War

Tries to tell a gripping story about WWI, but fails.

Among the quickfire game reveals of E3, *Valiant Hearts* stuck out. It looked stunning, it had a little dog and it sought to tell a story about the horrors of WWI. On the first two counts, *Valiant Hearts* makes good. The latter throws up problems, both in terms of how the game treats death and in how it's been structured alongside real historical information.

It's a puzzle-heavy adventure where you play four characters whose lives intertwine. Freddie is an American out for revenge, Anna is a Belgian woman working as a medic and seeking her father, and so on. The story isn't particularly challenging and barely touches on moral complexity or ambiguity.

The developers try to inject a note of tension by peppering the game with sections where your character is in danger. Shells fall, gunfire spatters battlefields, and spotlights expose your position when you're trying to escape capture. You can understand the temptation to create an active threat when you're

trying to describe an event that resulted in 8.5 million military deaths and millions more casualties, but the implementation unfortunately risks undermining the game.

Death is mostly a matter of inconvenience rather than poignance. Died from inhaling chlorine gas? Never mind, best respawn at that checkpoint a few metres back and try again.

That's the problem with a fixed character set and a fixed narrative. There can be no real death unless the writers have decreed it, and thus when the player is in control of the action there's no threat. You have a functionally immortal quartet (plus dog) roaming a devastated Europe. It's a dissonance that arrives early and doesn't leave. In a later chapter, the fail animation and the success cutscene are almost identical. Experiencing one then the other in quick succession flags the fact that I was just being asked to survive long enough for the game to take over and deliver the peril.

The puzzles themselves don't offer much variation, but they're solidly implemented. You're usually

pulling levers, throwing dynamite sticks, turning cogs and using Walt the dog to access any areas too small or dangerous for a human.

If you get stuck, a hint appears after a certain period of time. While this is useful, it makes it feel like *Valiant Hearts* is trying to dictate the pace of action, rather than you doing it.

The eye-catching art style, the adorable dog and the choice of a traditional storytelling approach all hint at a desire for accessibility by the widest possible audience. With the factual info it feels more like an educational project — something you might find distributed among schools or through museums.

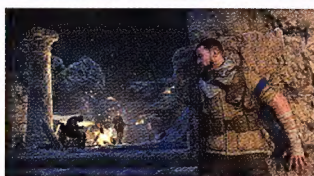
Essentially, better harmonisation is needed between interaction and the ideas. As it is, I just didn't invest in any of the characters. ■ Philippa Warr

Verdict

Visually arresting but mechanically lacklustre. It gets in the way of its own attempt to tell a story.



Though it contains ghillie sniper suits, Fairburne's adventure ain't got nothing on a Captain Price flashback.



FROM \$57 | PC, XBOX 360, XBOX ONE, PS3, PS4 | SNIPERELITE3.COM

Sniper Elite III

Rebellion pops more Nazi nuts in gratuitous slow-mo.

No one likes snipers anymore. Blame *Battlefield's* hill-campers, perhaps, or *Call Of Duty's* quick-scopers, but these days the art of scoring a headshot from half a mile away is frowned upon. UK developer Rebellion, however, disagrees, and continues to fetishise the work of the lone wolf sniper enacting long-range justice from behind enemy lines.

And fetishise really is the word for it. Most kills are met with a slow-mo cinematic that follows the bullet from your rifle to its target, the impact shown in *Mortal Kombat*-style X-ray vision. Skulls explode, rib cages rupture, internal organs spill out and testicles evaporate with a sickening pop. It's a neat trick, but it gets real old real fast, providing validation for those who claim videogames desensitise players to violence. If you've seen one nut shot, you've seen them all.

Thankfully, these gruesome cutaways can be skipped with a button press, and if you can look past the over-the-top violence there's a surprisingly complex web

of systems. *Sniper Elite 3* is a stealth game at heart, and you're given plenty of ways to stay out of sight. Throw rocks at nearby scenery, *Far Cry 3*-style, to lure guards off their scripted patrol routes for a stealth takedown. Use ambient noise – rumbling generators, planes roaring overhead, claps of thunder – to disguise the crack of your rifle. Even being spotted becomes an advantage – quickly relocate after being made and pick off the enemy as they converge on your former position, leaving tripwires and land mines in your snipery wake.

You guide US sniper Karl Fairburne on a series of lengthy undercover missions across North Africa during World War 2, levelling up as you progress, adding new weapons and rifle parts to your loadout (which can be customised between missions). The setting means this is a colourful game, if not a handsome-looking one: expect more blue skies and green foliage than you'd find in the average shooter, though this is hardly going to

justify a purchase on PS4.

It's a well conceived, smartly designed game, but it's been terribly made. The framerate hitches constantly in open areas. You're hemmed in by invisible walls that prevent you clambering up a two-foot sand bank. The sound mix is all over the place, with enemies who are 200 yards away sounding like they're right behind you. Shots sometimes miss inexplicably and mission-breaking bugs force you to reload earlier saves: at one point I'm unable to search a key corpse because a jeep full of Nazis parks on top of it.

It's a shame, because there are some fine ideas here, but they've been poorly executed – and the endless procession of splintered skulls and exploding testes simply isn't enough to make up for it. ■ Nathan Brown

Verdict

There's more than meets the eye (or lungs, or heart), but some shoddy finishing touches ruin this shooter.



The Fall

An adventure game housed in the shell of a platform shooter

US\$14.99 | PC
OVERTHEMOONGAMES.COM

You are ARID. ARID is an AI emergency system of a combat suit, activated after the suit's human pilot is injured. It's designed to control the suit and find medical help. You explore by moving through a dark, bereft planet, with only a gun for company. It looks like a side-scrolling shooter, but this is misdirection, really — *The Fall* is more like a point-and-click adventure game, updated for the gamepad age. It's standard adventure fare — use some items now to solve puzzles, collect others for later. As is often the case, some solutions are obvious while others leave you shaking your head. It's also easy to miss things, because of the way interactive objects are only revealed in ARID's torchlight. Still, there's logic to the puzzles usually, and some are set up very smartly. There is shooting as well. Switch ARID's torch for a laser sight and you can blast away things that aim to kill it and its pilot. The combat is pretty throwaway, though. A simple cover system gives it some variety, but it's generally slow and awkward. But *The Fall* is really about its story, pitting questions of ARID's validity against a mysterious disaster. It's compelling, thoughtful and well-acted, though sometimes its pace and that of the puzzles can clash. ■ Matt Bolton



Soylent: life imitates art, powder imitates food

Is there anybody out there who still doesn't know what 'Soylent Green' is made from?

Just in case... we won't spoil it here. Suffice to say, we're relieved that the fictional foodstuff from the creepy '70s sci-fi cult film that shares its name doesn't actually exist for sale in 2014. Although, bizarrely enough, one real-world food is now available for purchase and it takes its name directly from the same source. Soylent (www.soylent.me) is the brain-child of a few US techie entrepreneurs, who, when frustrated with the hassle and expense of buying and cooking food, sought to break down the core elements of what we need from food – ie. carbohydrates, protein, fat, vitamins and so forth – in order to replicate it in one easy-to-make instant powder drink.

The result, now successfully crowdfunded, is Soylent: kind of like a protein shake, except it's not a supplement or occasional meal replacement. Soylent is everything you need to eat. Ever. A complete food alternative. Yep, it might not be fictional like its tongue-in-cheek inspiration, but this Soylent still very much seems like something out of a science fiction film. Stranger still, people are actually buying the stuff, and the open-sourced ingredients list means you can even blend a batch yourself, with whole 'DIY Soylent' communities thriving online. The commercial product itself isn't yet for sale outside the US, although the official site FAQ cheerfully advises international visitors to "stay tuned for more updates!" Is this the end of food as we know it?



PAVLOK FITNESS TRACKER, NOT FOR THE SQUEAMISH

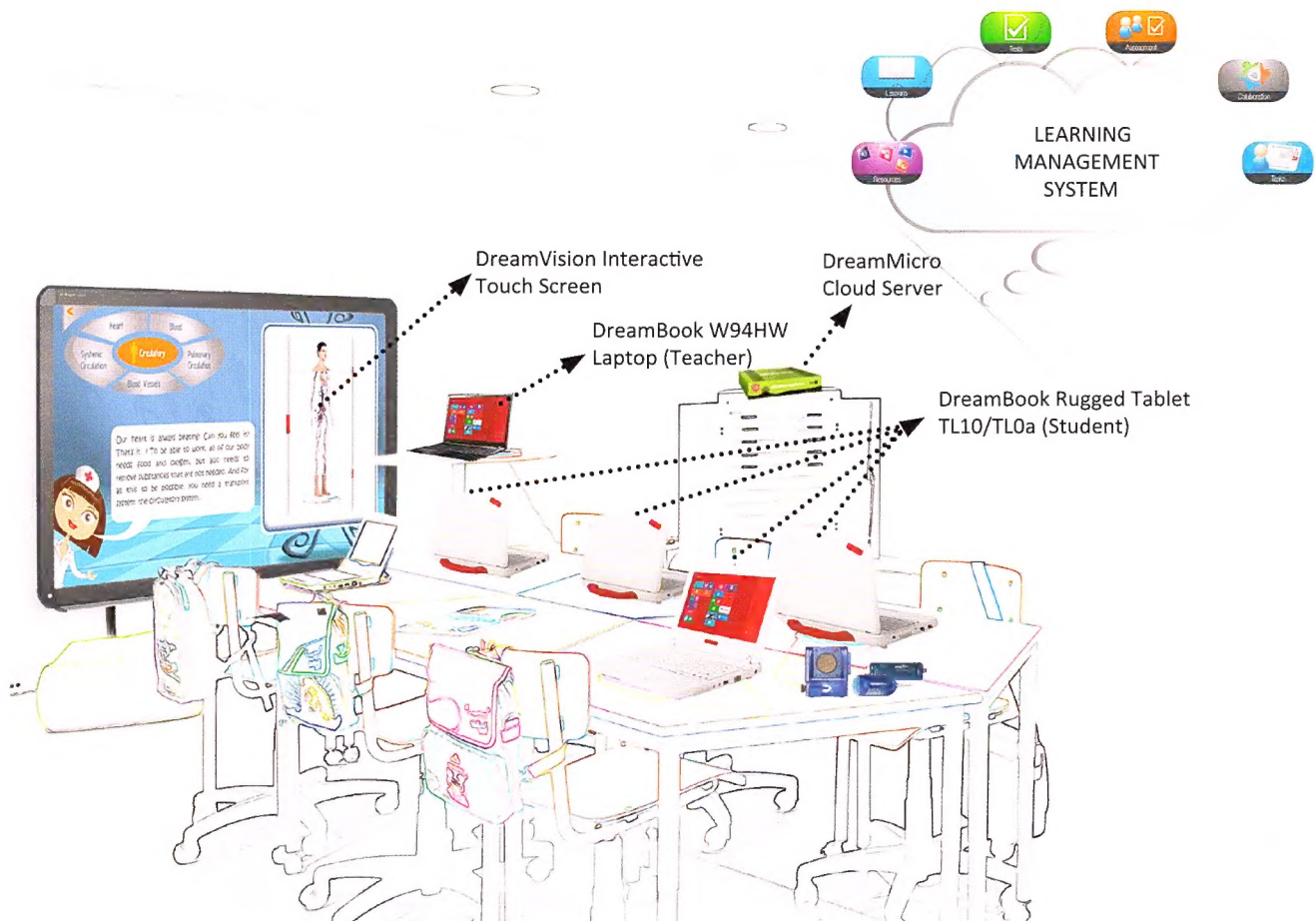
Fitness wearables are all the rage right now, with oodles of personal activity trackers vying to gain a spot on your wrist, belt or pocket, and at first glance, Pavlok looks like all the rest... an unremarkable wrist-band gadget.

But there's a mischievous streak in this one lurking underneath its otherwise generic appearance. Like its contemporaries, Pavlok, working in conjunction with a smartphone app, lets you set personal, quantifiable goals for fitness and personal behaviour – like taking x many steps per day, or getting up early in the morning to go for a jog. But what happens if you don't perform? Other fitness trackers, like Fitbit and Jawbone, tend to focus solely on positive reinforcement to help you attain your goals, awarding you badges and unlocking achievements to reward you for doing exercise and getting fit. Pavlok does this too, but it's a cruel taskmaster if you let yourself off easy, incorporating a range of punishments to alter any slacker behaviour it registers, including making you pay fines, social shaming by auto-posting your failures on social media, blocking access to your phone, and even administering small electric shocks in a bid to help users "unlock their potential. Pavlok is still in development with shipping expected in 2015, but if you're the type who's constantly failing to compete the tasks you set for yourself – or, you know, you're just into sadomasochism – prototypes and pre-orders are available now at pavlok.com.

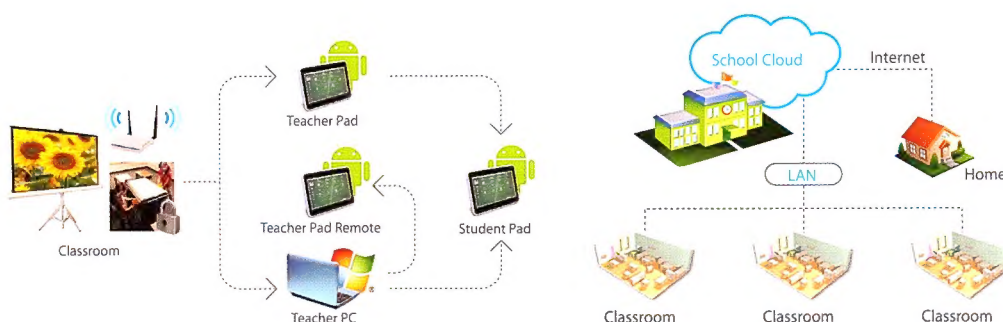


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